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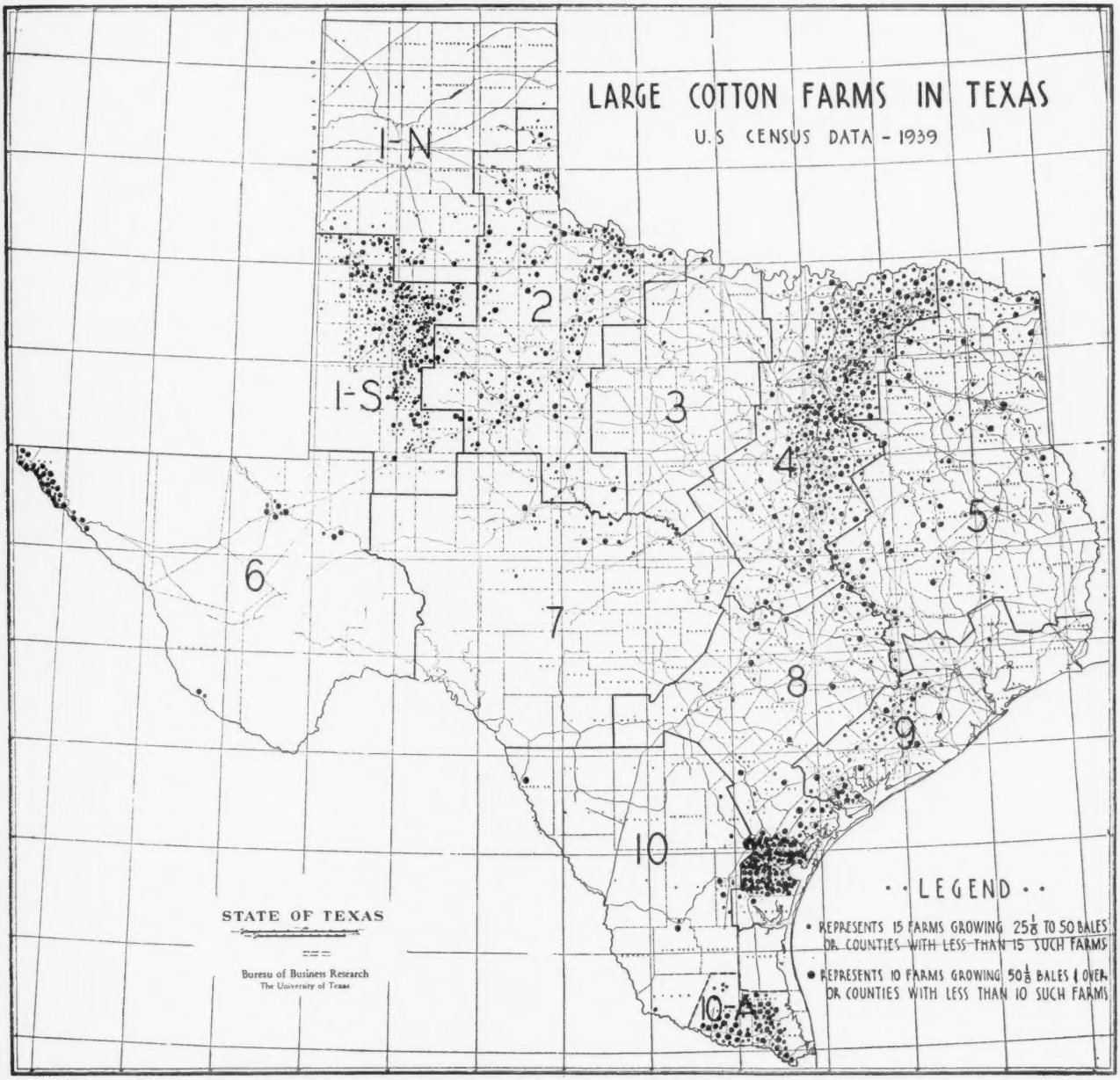

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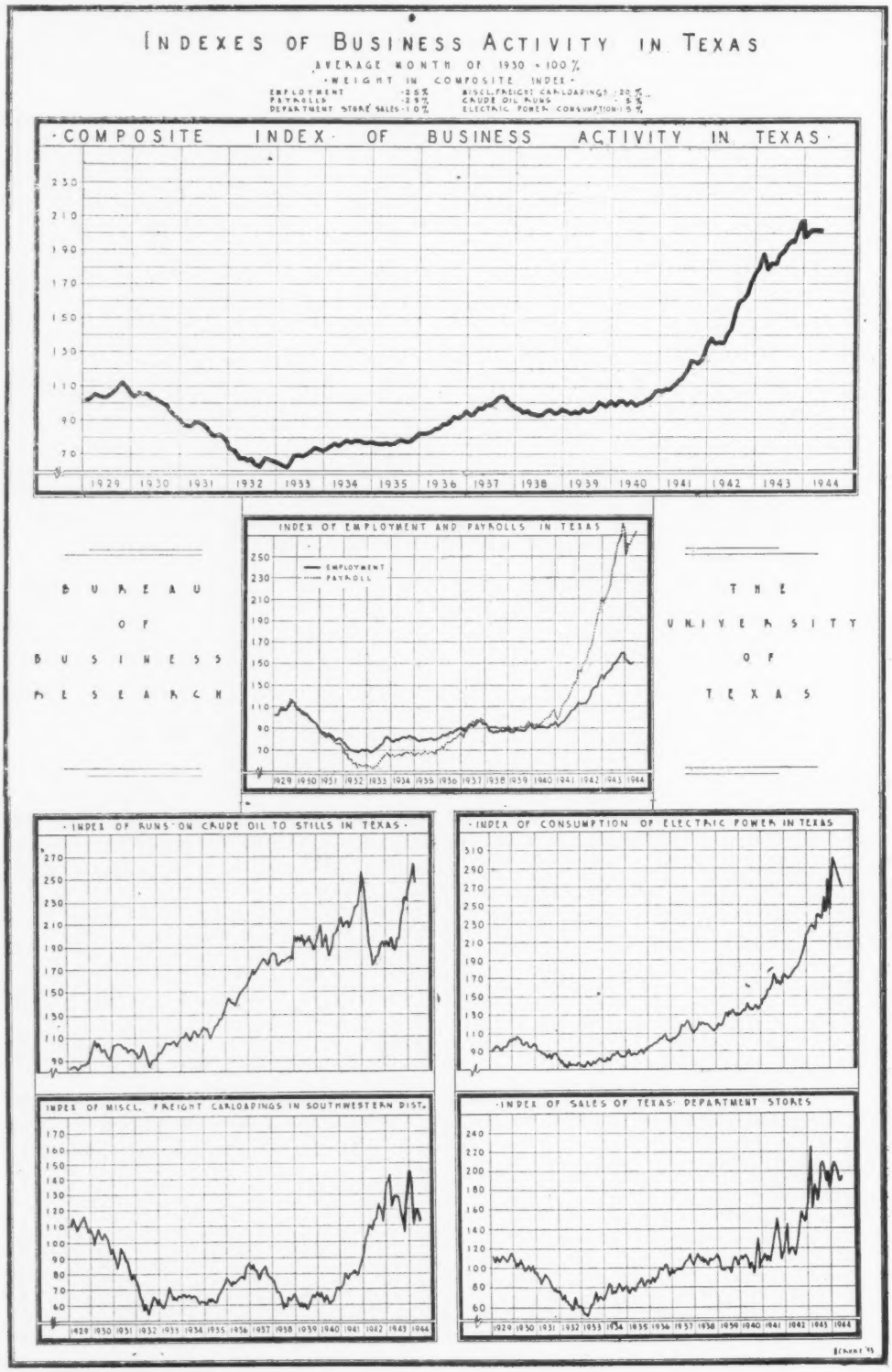
INDEXES OF BUSINESS ACTIVITY IN TEXAS
AVERAGE MONTH OF 1930 = 100%
WEIGHT IN COMPOSITE INDEX
EMPLOYMENT 25%
PAYROLLS 25%
DEPARTMENT STORE SALES 10%
MISCL. FREIGHT CARLOADINGS 20%
CRUDE OIL RUNS 5%
ELECTRIC POWER CONSUMPTION 5%
COMPOSITE INDEX OF BUSINESS ACTIVITY IN TEXAS
INDEX OF EMPLOYMENT AND PAYROLLS IN TEXAS
EMPLOYMENT
PAYROLL
BUREAU OF BUSINESS RESEARCH
THE UNIVERSITY OF TEXAS
INDEX OF RUNS ON CRUDE OIL TO STILLS IN TEXAS
INDEX OF CONSUMPTION OF ELECTRIC POWER IN TEXAS
INDEX OF MISCL. FREIGHT CARLOADINGS IN SOUTHWESTERN DIST.
INDEX OF SALES OF TEXAS DEPARTMENT STORES

Business Review and Prospect

TEXAS BUSINESS REVIEW

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BUREAU OF BUSINESS RESEARCH
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Much greater reason now exists for believing that the war in Germany will end within the next few months than was true last summer, when the prediction by high authorities was being freely made that V-E would occur in the fall of 1944. At that time, much concern was expressed regarding problems of reconversion from war to peace economy and there was quite general agreement that the fall of Germany would be accompanied by serious dislocations in industry and business. With victory obviously now much nearer, opinions as to the effect on our economic situation when Germany falls have changed.

Washington authorities recently have made it plain that cutbacks, upon the defeat of Germany and up until the fall of Japan, will be of minor proportions; and they have made known that troops moved from Europe to the Orient will be largely re-equipped, leaving the bulk of their weapons and vehicles behind. Thus the present and prospective business situation, which is dominated by expansion in the war program and by the pressure to keep the war effort at the maximum, leaves little room for expecting an increase of civilian production; and even talk of reconversion is now almost at a standstill.

In spite of the positive statements from Washington to the contrary, some believe that with victory in Europe achieved, greater cutbacks than are now talked of will be possible, especially when stockpiles and current production of munitions are measured against the requirements for carrying on the war with Japan. At any rate, business should take into account the possibility of a temporary slump with the cessation of major hostilities in Europe, and not proceed too boldly on the assumption that present industrial conditions will continue indefinitely without interruption. The conservative policy is to keep inventories and finances in good order so as to be prepared for contract terminations and settlements, and to have post-war plans ready as far as is consistent with meeting war needs.

When viewed from the financial angle, the current and prospective encroachments upon civilian production strongly suggest increasing inflationary pressure. Money in circulation is now more than 275 per cent above the 1935–1939 average level; the national income is up nearly 150 per cent; and bank deposits have gained nearly 125 per cent. While prices of farm products have risen substantially, approximately 65 per cent, above the low average level which prevailed during the base period 1935–1939, prices of commodities, other than farm products, now average but 20 per cent above the 1935–1939 level. Thus, on the one hand, there is a growing backlog of deferred demand as a result of restrictions on civilian production; and on the other hand, a tremendous and growing reservoir of buying power, as indicated by the sharp rise in money in circulation, national income, and bank deposits. In addition, individual ownership of war bonds runs into billions of dollars and personal debts have been largely liquidated or reduced and individual credit ratings improved.

If this huge reservoir of buying power can be held intact until the greatly expanded productive capacity of the Nation can again concentrate upon the making of high quality goods for civilian use, a basis would exist for record peacetime business, and an unprecedented rise in the standard of living. That which is even more significant, the threat of runaway inflation would be greatly reduced; while on the opposite extreme, the often expressed fear of deflation would be correspondingly minimized. Obviously, there is a great need for a sound program of public information during this period of rapid economic transformation.

Texas Industry and Trade

Texas ranks among the top ten or twelve states in the Nation in per capita value of war supply and facility contracts, and it is far in the lead of any other state south of the Mason and Dixon line in these respects. With the exception of the aviation, shipping, and ordnance industries, no formidable reconversion problems are anticipated in this State; and there is ground for belief that in the areas of high war industry concentration, local leadership together with state and Federal agencies are making substantial progress in the formulation of plans for meeting the employment problem when the transition from war to peace economy gets into full swing at some indefinite future time.

It is hoped that these efforts for the development of industries will not be confined to increasing the number and capacity of existing plants, but that adequate attention will be given to setting up new industries based upon a wide range of raw materials which have increased by leaps and bounds in this State to meet war requirements. Practically all of the chemical raw materials, production of which have been developed or expanded on a mass production basis in Texas during the past few years, have great possibilities in the manufacture of goods for civilian consumption; and those which

have thus far been developed are far from exhausting the list of possibilities. With the development of new consumer goods industries in this State, not only will jobs be created but the products of these industries can be made available to the Texas consumer at a lower price than if manufactured at more distant points, because of savings in freight and other marketing costs. The effects of growing payrolls and declining prices of manufactured goods will be reflected in improved living standards among all classes of the State's population. The need for the most aggressive thought and action at this time, looking toward establishment of new industries of the types mentioned is not reduced by the fact that deferred demand for goods and accumulated buying power will for a time after the war maintain business and industry on a high level; on the contrary the need for such new industries is emphasized by the fact that the old established industries will not be able permanently to take care of those seeking jobs when their backlog of orders begins to dwindle.

Current Business Activity in Texas

Business activity in Texas during the first two months of the year was well above that of the corresponding period a year ago. Department store dollar sales for the year to date were up 18.6% from the corresponding period last year, and the February gain over the similar month last year was 16%. Credit sales continue relatively low in comparison with the pre-war period, indicating that customers are paying cash for their purchases. The ratio of credit sales to total net sales in February did not, however, vary much from that of a year ago. The ratio of collections to outstanding accounts not only continues far above the pre-war period, but is still increasing as indicated by the fact that February collections amounted to 67% of outstandings compared with 63% in February last year. This rising trend, however, has probably about reached its peak.

Postal receipts in a selected group of Texas cities continue the year to year gains, which have been noted for many months. February receipts were 16.5% greater than those for the corresponding month last year.

Total value of building permits in a representative group of Texas towns and cities showed a substantial gain over February last year, aggregate permits increasing from $2,085,268 in February, 1944, to $3,495,639 in February, 1945, or 67% for the year to year comparison. Although the percentage gain is quite impressive, the actual amount of building still is relatively small and will necessarily continue so until the war restrictions upon building materials and labor for civilian construction are relaxed.

Oil production in Texas increased from an average daily rate of 1,911,300 barrels during February, 1944, to 2,147,350 barrels during February of the current year, or more than 12%. For the nation as a whole, the increase was from a daily rate of 4,401,800 barrels to 4,755,550 barrels or 8%. The total daily increase in oil production in the Nation during February, over that in the corresponding month last year, was 354,750 barrels, of which increase, Texas contributed 236,050 or 66.6%. This accomplishment receives added emphasis from the fact that the increase in daily production of Texas oil is but a continuation of a trend that has prevailed since our entrance into the war; and the further fact that oil prices have remained virtually stationary during this period.

February Farm Cash Income

Income from agriculture in Texas during February totalled more than $57 million compared with $50 million during February last year—or an increase of 14%. Aggregate farm cash income for the first two months of the year was $160 million as against $118 million during the corresponding period a year ago, or a gain of more than 36%. It is noteworthy that cash income from fruits and vegetables during February amounted to more than $11 million in District 10–A—the Lower Rio Grande Valley—consisting of Cameron, Willacy and Hidalgo counties and that this was nearly 20% of the farm cash income of the entire State during the month. From the indexes of farm cash income in the accompanying table it will be seen that cash income in the three counties of the Lower Rio Grande Valley was more than six times as great in February, 1945, as it was in February of the base period 1928–1932. A much larger percentage of the Texas annual farm cash income is now being received during the winter months than was true in the late '20's. For the State as a whole, the February, 1945, index was 352.3% of that in the base period 1928–1932. This situation is the result of the growing importance of winter fruits and vegetables; and also of the larger percentage of the income derived from livestock and livestock products, which are marketed more uniformly throughout the year than are crops such as cotton and wheat, the bulk of which is marketed during the comparatively small portion of the year in which such cash crops are harvested. This seasonal shift in farm cash income has become increasingly pronounced during the past decade as livestock, livestock products, fruits and vegetables have gained in relative importance in the State's agricultural economy.

INDEXES OF AGRICULTURAL CASH INCOME IN TEXAS

(Average Month 1928–'32 equals 100)

Districts	Feb., 1945	Jan., 1945	Feb., 1944	Cummulative Cash Income in Thousands of Dollars Jan.-Feb. Inclusive 1945	1944
1–N	281.4	255.1	174.5	13,667	8,346
1–S	465.3	596.8	491.0	17,881	14,001
2	286.4	677.8	298.8	23,155	10,883
3	432.6	367.6	263.8	7,109	4,396
4	266.3	374.4	248.4	21,036	16,257
5	203.7	425.0	261.3	7,352	5,498
6	349.0	271.0	251.7	7,324	5,741
7	283.9	358.5	265.7	5,571	4,281
8	303.6	471.3	299.3	10,859	8,137
9	361.7	642.7	358.8	16,421	15,271
10	477.6	755.1	210.2	6,317	2,671
10–A	625.7	618.5	520.4	23,328	22,032
STATE	352.3	468.3	307.4	160,020	117,514

The revised farm cash income in District 5 for 1944 is $72,512,000 and the corresponding revised figure for the State farm cash income is $1,154,787,000.

Note: Farm cash income as computed by the Bureau understates actual farm cash income by from six to ten per cent. This situation results from the fact that means of securing complete local marketings, especially by truck, have not yet been fully developed. In addition, means have not yet been developed for computing cash income from all agricultural specialties of local importance in scattered areas throughout the State. This situation, however, does not impair the accuracy of the indexes to any appreciable extent.

Livestock Numbers on Texas Farms and Ranches

Inventories of commercial livestock on Texas farms and ranches January 1, 1945 were, with the exception of hogs, only slightly different from those of the corresponding date a year ago. Cattle numbers declined less than 1%; sheep 1.3%; but hog numbers dropped 35%. The only class of livestock that registered an increase in numbers was goats and these animals are commercially important primarily for their product.

It is thus apparent that if the year to year increase in farm cash income from livestock and livestock products which has prevailed during the past several years is to continue during the current year it will be as the result of a higher level of prices, larger crops of young animals available for market or encroachment upon inventories which would leave the numbers on farms and ranches on January 1, 1946, smaller than on that date this year. The level of farm prices of livestock and livestock products is now moderately higher than it was at this time last year and there is ground for belief that the present favorable price margin will, at least, be maintained. It remains to be seen whether there will be an increase in production, and a cut into inventories.

F. A Buechel

Liquid Assets—An Inflation Potential

During the past four and a half years of war, government, industry, agriculture, and labor have combined to produce a record production of goods for military and lend-lease purposes. At the same time our productive system has maintained the production of goods and services for civilian consumption at levels so high as to avoid any more serious impact upon the civilian population than mere occasional inconveniences.

The nation's remarkable production record, however, has not been accomplished without accompanying financial developments which raise serious problems for the future. These are problems which must be recognized and which must be met successfully if serious post-war consequences are to be avoided. Fortunately, during the war period the Government has maintained an extensive and somewhat stringent system of economic controls. These controls have unquestionably been very effective in stabilizing the economic system. Without them the cost of the war would be enormously greater, and the disruption and chaos in our economic system would be so great as to threaten the existence of reasonably normal economic relationships.

Despite the effectiveness of government controls and the ability of our productive system to maintain its high output of goods the financial trend and pressures are, on balance, clearly inflationary. The fact that government controls have been, generally speaking, very effective may tend to obscure the dangers inherent in financial developments which have occurred. Therefore, as a matter of reasonable caution it is only prudent to examine certain characteristics of the current financial situation with a view toward evaluation of their potentialities.

One of the most significant characteristics of the present financial situation is the extremely high state of liquidity which prevails. Immediately available purchasing power of the nation is reflected by the sum of the adjusted demand deposits of all banks plus the volume of currency in circulation outside of banks and the Treasury. At the end of November, 1944, adjusted demands deposits of all banks were estimated at approximately 72 billion dollars, and the currency in circulation outside of banks and the Treasury was estimated at more than 23 billion dollars. In other words, individuals, business firms, and other potential purchasers had in their possession at that time a sum of immediately liquid assets totalling more than 95 billion dollars. That total of cash holdings compared with cash holdings in May, 1940, of approximately 38.6 billion dollars, on an increase of 146 per cent.

Despite the payment of record income taxes and substantial loans to the Government in the form of purchases of government bonds, individuals added approximately 16 billion dollars to their cash holdings during the first eleven months of 1944.

In addition to this vast sum of cash holdings, an enormous volume of liquid assets in the form of time deposits and Series E bonds is in the possession of individuals. During the first eleven months of 1944 time deposits in all banks increased by more than 6 billion dollars to reach a total of approximately 39 billion dollars. The volume of Series E bonds outstanding at the end of November, 1944, totalled almost 24 billion dollars. In other words, in addition to cash holdings of approximately 95 billion dollars, a sum of potentially highly liquid assets amounting to approximately 63 billion dollars was in the possession of individuals as of November, 1944.

Indications are that liquid savings and cash holdings will continue to increase for the duration of the war. Regardless of the probability that the German war will end this year, the increase during 1945 probably will not be substantially less than that of preceding years. After the peace in Europe, for the duration of the Japanese war these funds should continue to increase but at a decreasing rate. Income taxes probably will not be increased above present levels, and incomes will continue for the duration to exceed substantially the value of goods available for civilian purchases.

The fact that individuals have saved such a large part of their income obviously has been a most important factor in stabilizing the economy during the war period. Likewise, if utilized in all respects wisely, this huge backlog of savings and vast fund of cash assets can be made a powerful stabilizing factor during the period of reconversion of the country's economic system to a peace basis. But it must not be overlooked that this fund of potentially effective purchasing power also has inherent within it tremendous inflationary pressure. The conversion of any part of the fund of liquid savings into cash holdings, and a possible subsequent demand for commodities and services rests upon the voluntary decisions of the savers.

The assumption that such voluntary decisions will, in the mass, be rational and that the group of savers will attempt only to satisfy their demands for goods in a reasonable, orderly manner is too dangerous an assumption to accept. If it should prove to be contrary to the fact, the inflationary force could not be stopped short of destructive consequences.

Government controls must be maintained in force, and must be supported by the public, until the Japanese war is finally won and until our productive system has been reconverted to a basis of civilian production and has attained an output of goods at a level of prices consistent with production costs which will approximate the demand for goods as expressed by the volume of effective purchasing power flowing into the market. Until civilian production has been stabilized in terms of effective demand at an equitable level of prices the inflationary potential in the financial system cannot have been considered either as controlled or eliminated.

Experience with government controls during the war period indicate that they are effective only up to a certain point; that sooner or later the inflationary pressures build up sufficient force to break through control levels.

It is not necessary to trace the course of price stabilization to establish this fact. It is generally known and recognized that the record of price stabilization, which reflects not only the efforts of the price control agency but also those of other control agencies whose operation influences or conditions price control, has been characterized by a series of "holding and retreating" movements.

The high degree of stabilization which has been maintained since about May, 1943, has been the result of a combination of factors. Despite shortages in many commodities the over-all volume of civilian goods available has been reasonably adequate and equitably rationed where necessary. Liquid cash holdings of individuals have been at least partly held in check by large taxes and investment in war bonds. Also the public attitude with respect to spending and compliance with control measures has been, on the whole, coöperative. Subsidies have played an important part in stabilizing the prices of many food items. The price control agency has improved its methods of control and thus raised the efficiency of its operation, while at the same time causing only a minimum of regimentation, really very little dislocation of industry, and without unfavorable effect on profits of private industry generally.

As the war draws to a conclusion and the reconversion to a peace economy is begun, financial trends will to a certain extent be mixed, with both inflationary and deflationary forces at play. There are strong reasons to believe, however, that the inflationary forces will prevail on balance. The tremendous fund of purchasing power in individuals' hands in the form of liquid assets will continually seek ways to move to satisfy the long stifled, pent-up demand of individuals for goods. Either goods must be made available to satisfy that demand as it materializes or the demand will break through control levels.

Stabilization policies, and particularly price control policies during the reconversion period must be flexible and must fit a dynamic, changing economic situation. It should also be recognized by the control agencies that the economic situation which will prevail in 1946 or 1947 will not be the same economic situation which prevailed prior to the war. The pre-war price levels, or pre-price control price levels, should not be endowed with a sanctity which tends to cause an attempt to hold such prices even though it may be obvious that those prices cannot be held because of cost increases which have worked their way into the economic system during the several years of war, and which have not at the time of reconversion been reduced or eliminated.

Price control should be directed toward the stabilization of prices at that level which, in view of prevailing costs, will obtain the maximum production of goods under a system of private enterprise operating at a reasonable rate of profit. The price control agency and other supplementary agencies should make every effort to assure that their policies and actions are shorn of red-tape, procrastination and delay to the greatest possible extent. Under certain circumstances and in some cases, such as, for example, the production of new products for which reliable cost data are not available, or in the case of new producers who lack production cost records, it may be necessary to sacrifice to some extent theoretical perfection of price determination in order to permit the start of production. A reëxamination and, if necessary, an equitable adjustment of such prices after a reasonable trial period of production would make it possible to correct any injustices which might appear in prices too high or prices too low. Furthermore, after goods begin to flow into distribution channels in sizable volume competitive forces will begin to exert their influences toward the correction of price inequalities.

Price control must operate in such a way as to expedite the reconversion to civilian production and encourage the rapid production of new goods, while at the same time stabilizing prices in relation to the effective purchasing power and the available supply of goods.

The problem is an extremely difficult one. It is as difficult in fact and fraught with as many dangers as has been the problem of war-time price control which, in view of all circumstances, has been so effectively accomplished. Despite its difficulty, however, this new problem must be met successfully if our accomplishments so far are to be held and if serious damage to the economic system is to be avoided. The stabilization agencies must continue to operate as a part of our economic system during the reconversion period. Their policies and operation must be of such character as to solve the difficulty, though not impossible task of turning the inflationary financial potential which exists in the form of a huge fund of liquid assets into advantageous, productively useful channels.

WATROUS H. IRONS.

Mechanization of Cotton Production

Mechanization of raw cotton production is of vital interest primarily for two reasons: first, as a means of lowering costs of production, as one means of enabling cotton to hold its effective competitive position in national and world markets as a raw material: and second, as the basis of new industries and trades in making, distribution, and servicing, the machines and other equipment required in mechanization.

This article deals with only one phase of mechanization of cotton production, that of harvesting.

There are two types of mechanical cotton harvesting equipment being developed and used. The first method to come into prominent use was what is known as the cotton sled, which is a stripper type of harvester, which originally was and can be built by the farmer for a few dollars.

The sled type of stripper is being superseded by commercial strippers being built with more or less cleaning equipment which cost from $750 to $1,200. These machines harvest a greater per cent of the cotton, and get less trash than the farmer-built sled.

It is estimated that the two-row type of commercially manufactured stripper can harvest an average of ten acres per day, and can operate about 30 days a season on the High Plains, the place it is being used predominantly, and harvest from three to five bales per day, depending on the yield per acre. Two persons are required to operate the equipment, one to drive, and the other to handle the cotton. The short operating period is due to the fact that it is practical to use strippers only after frost has caused all the cotton to open.

It is estimated by the Texas Agricultural Experiment Station that a family with four-row equipment can grow 300 acres of cotton, which would be about the annual capacity of a two-row stripper.

On the basis of 200 pounds of lint per acre, that would mean the harvesting of 120 bales per season.

In 1943 the cost of snapping cotton, the prevailing method of harvesting cotton on the High Plains, was $1.50 per hundred, or $27.25 for 1850 pounds, the amount required for a bale. The cost of stripping by machine methods was $6 per bale, and the grade was about the same. The saving to the farmer resulting from the use of the stripper was thus $21.25 per bale in this case, or a total saving of $2,500 on the total crop from 300 acres, yielding 200 pounds of lint per acre.

These figures indicate that farmers growing over 50 bales of cotton per year in the High Plains would find the ownership of a stripper machine economical for the harvesting of their own cotton.

Farmers growing from 25 to 50 bales per year on the High Plains where snapping is now the prevailing method of harvest would be able to cut their costs by harvesting with a machine stripper, individually or cooperatively owned or hired. All farmers who hire cotton snapped could afford to hire a stripper at any figure materially less than $27.25 per bale,

What then is the potential market for these strippers? At the present stage of technological developments and scientific cotton breeding it has proven practical to use the stripper only after frost. The stripper type of harvester then is practical in present stages of development where the cotton matures nearly all at once and about at frost time. These conditions prevail in the High Plains of Texas, crop-reporting Districts 1–S and 1–N, and to a lesser degree in the rolling plains of Texas, crop-reporting District 2, and in western Oklahoma.

Table I shows the number of farms reporting cotton in 1939 by crop-reporting districts, and the number producing 50 1/8 bales and over, 25 1/8 to 50 bales, and average production by districts. See cover page for map.

TABLE I

LARGE COTTON FARMS IN TEXAS BY CROP-REPORTING DISTRICTS

Census of 1939

Crop-Reporting Districts	Total Number Farms Reporting Cotton	Farms Producing 50 1/8 bales and over	Farms Producing 25 1/8 to 50 bales	Average Production 1940–44 500-lb. bales
1–N	3,667	83	304	56,000
1–S	12,672	1,334	3,229	491,000
2	25,380	602	2,525	586,000
3	9,042	5	31	55,000
4	69,343	1,100	4,558	698,000
5	90,071	308	945	308,000
6	1,449	296	227	76,000
7	4,424	24	143	50,000
8	35,629	887	994	290,000
9	11,775	171	606	130,000
10	4,346	21	87	31,000
10A	5,004	321	551	90,000
State Total	272,803	5,142*	15,300*	

*State total exceeds these because some counties may have farms with more than 50 1/8 which is reported as above a smaller unit.

These figures indicate there is a potential market for between 3 and 5 thousand such machines on large farms on the High Plains, and a substantial number in District 2.

The picker type of harvester has been perfected to the point that its adoption on many large farms is assured.

This type of harvester has proven much more useful in the areas of longer growing and harvesting seasons, and where longer staple cottons are grown. The picker machines cost much more, and at present stages of development, will prove practical on only very large farms, or for commercial operation. Table II shows the large farms by states. These data show that the major market areas for the picker machines are in the Mississippi Valley area, the black prairies of Texas, the Rio Grande Plain, and the irrigated areas in the Southwest growing medium staple cotton.

TABLE II

LARGE COTTON FARMS BY STATES

States	Total Number Reporting Cotton	Number of Farms Producing			
		50 1/8 or more bales	25 1/8 to 50 bales	10 1/8 to 25 bales	10 bales and under
U. S. Total	1,589,706	16,492	35,651	193,584	1,343,979
Alabama	200,649	327	995	9,024	190,303
Arizona	2,002	761	294	390	557
Arkansas	150,667	2,130	4,252	24,844	119,441
California	5,316	1,808	1,140	1,426	942
Florida	8,883	....	6	36	8,841
Georgia	167,256	694	1,876	14,254	150,432
Illinois	418	8	25	70	315
Kansas	21	....	....	5	16
Kentucky	2,180	33	82	232	1,833
Louisiana	114,291	566	921	10,237	102,567
Mississippi	259,529	1,171	2,394	31,356	224,608
Missouri	16,678	1,601	3,152	6,133	5,782
New Mexico	2,829	473	490	797	1,069
North Carolina	103,248	120	760	8,420	93,948
Oklahoma	86,889	319	1,660	9,960	74,950
South Carolina	111,618	901	2,435	17,725	90,557
Tennessee	777,405	348	802	6,981	69,274
Texas	272,803	5,230	14,351	51,641	201,581
Virginia	7,024	....	8	53	6,963

In terms of wages paid, cotton picking or snapping is the best-paying job in cotton production. The result is that at prevailing prices it would pay the farmer who grows no more cotton than he and his family can pick to hand pick his cotton, even though a machine were available to do it. This will include perhaps 75 per cent of all farmers. By the same token, the large farmer who must hire many pickers can afford to buy mechanical equipment, for, while the cost of labor for picking has gone up, the cost of equipment in terms of interest rates and depreciation has gone down. Data presented indicate that perhaps a fourth to a third of present cotton production might be completely mechanized economically.

A. B. Cox.

COTTON BALANCE SHEET FOR THE UNITED STATES AS OF MARCH 1, 1945

(In Thousands of Running Bales Except as Noted)

Year	Carryover Aug. 1	Imports to March 1*	Gov't Est.* as of Dec. 1	Total	Consumption to March 1	Exports to March 1*	Total	Balance to March 1
1935–1936	7,138	56	10,734	17,928	3,014	4,004	7,018	10,910
1936–1937	5,397	72	12,407	17,876	3,435	3,848	7,283	10,593
1937–1938	4,498	46	18,746	23,290	3,078	3,832	6,910	16,380
1938–1939	11,533	77	12,008	23,618	3,397	2,192	5,589	18,029
1939–1940	13,033	66	11,792	24,891	4,042	4,170	8,212	16,679
1940–1941	10,596	58	12,686	23,340	4,423	654	5,077	18,263
1941–1942	12,367	†	10,976	23,343	5,391	793	6,184	17,159
1942–1943	10,590	†	12,982	23,572	5,628	†	5,628	17,944
1943–1944	10,687	†	12,120	22,807	5,902	775‡	6,677	16,130
1944–1945	10,727	103‡	12,195	23,025	5,659	1,050‡	6,709	16,316

The cotton year begins August 1.

*Figures are in 500-pound bales.

†Not available.

‡Figures to February 28—Source: N. Y. Cotton Exchange.

Industrial Potentialities of Texas

Part I

Were it possible by some stretch of the imagination that the rich and diversified mineral resources of Texas could be transferred overnight into some other State—for instance, California, Pennsylvania, or New York, or even West Virginia—it might be worthwhile to consider how that State would immediately benefit thereby. Could such a transfer be made, there is no doubt but that the immediate resulting industrial development based upon the availability of such a wealth of natural resources would indeed be of spectacular proportions, and that it would be inaugurated on an almost unbelievably broad scale without a moment's hesitation. There would be no question as to the interest in or the support for research to deal adequately with such a tremendously significant natural endowment. Consideration of the utilization of such natural resources would not be dominated on the one hand by the traders' psychology; nor would the economic significance of such resources be circumscribed and confused on the other hand by flamboyant expressions of speculative philosophy. The point for consideration, is of course, having this rich natural endowment within its borders, what is Texas going to do with these large reserves of its diversified mineral resources capable of supplying raw materials for industry in great diversity as well as in vast volume?

This article will be concerned primarily with but one line of *industrial potentialities* of Texas—that of synthetic organic chemicals, based upon the petroleum and natural gas resources of the State. No attempt will be made to cover the innumerable details which abound in the problem as a whole; instead, the emphasis is placed upon the bigger picture, in shortest possible compass, supported by only the essential details, and presented from the standpoint of summarizing the fundamentals of the problem.

These industrial potentialities, of the utmost significance to the future of Texas, could hardly be overestimated. Certainly, oil companies and chemical companies are awake to the possibilities. The president of Tide Water Associated Oil Company recently stated: "The field of petroleum chemistry is of extreme interest to this company. It involves the manufacture of organic chemicals from gaseous and liquid petroleum hydrocarbons available from refinery and gas cycling plant operations. This field appears to have an important future, particularly in the postwar period."

That the countries of the postwar world will require huge quantities of chemicals of practically all sorts can hardly be questioned. The almost spectacular developments in the United States of the past two decades in the production of chemicals from the aliphatic hydrocarbons supplied by or derived from petroleum and natural gas must be recognized as one of the outstanding achievements in the history of the chemical industry. Furthermore, important as the achievements in this phase of the chemical industry certainly are, it is recognized that they represent only the beginnings, although substantial beginnings, of this phase of chemical industry development. And nowhere in the United States do the potentialities for further expansion and enlargement in these lines of industry hold greater promise than in Texas and adjacent States.

Shifts in Chemicals Production

World War II has witnessed a tremendous expansion of chemical industries in the South at large; these developments, however, reflect trends in the geographic dispersion of industry in the United States that were well begun prior to this war.

The immensity of this shift, as well as its significance in the evolving economic structure of the United States, when properly evaluated, fully analyzed, and scientifically interpreted, will appear as one of the great industrial movements of all time.

It is indeed high time that the shifts into and developments of these industries in Texas and the Southwest be properly evaluated not only as to what they have meant to the war effort but also and more particularly as to what they promise in the postwar economy of this section of the United States as these industries develop still further—that is, *if* and *when* and *how* they are developed on a scale at all commensurate with the potentialities of this section of the United States.

It is necessary in analyzing these shifts of industry into Texas and the possibilities for further industrial growth in the State to consider two basic propositions:

a) First is the all-inclusiveness of the industrialization movement, affecting every portion of the earth no matter where it is situated. Whatever doubts regarding expansion of industry that may have lingered on in some minds have been pretty well dispelled by the actualities of World War—through concrete happenings on every hand, the impacts of which have become all but universal in occurrence.

b) Second is the scope of potentialities which Texas possesses by virtue primarily of its wealth of diversified natural resources.

Unquestionably, many have looked askance upon the large developments that have come to Texas during the war, mostly those who have taken little time and less effort to examine the basic facts of the situation. Competent analysis of the substantial economic factors concerned in the over-all situation would lead probably to the conclusion that Texas should have had considerably more of these developments than it has; certainly, even at this date, more of such developments are being launched in Texas as part and parcel of the larger war effort, and perhaps even more are yet to come to the State.

By no means are the potentialities of the chemical industry in Texas limited to synthetic organic chemicals; this group of chemicals, however, is emphasized in this article because of their tremendous potentialities for further development and extension in the State. They set the stage, so to speak, and at the same time furnish abundantly by the very tempo of their progress and scope of their advances the mainspring—the dynamic forces—about which so many other industrial possibilities pivot, and upon which still other industries depend.

Some of the potentialities in other chemical industries and related lines will be considered in a later article. All that can be said here is that all of these lines of development, actual and potential, are interrelated and interdependent and that developments in one important line opens possibilities for substantial advances in numerous other lines. Advances made in the basic industries in turn set the pace for growth of other types of industries, particularly those supplying consumers' goods.

In order to have a wide range perspective of the situation as it pertains to the chemical industry it is appropriate to emphasize the fact of the rapid tempo at which new chemical industries are currently being set up and expanded, for the United States as a whole, and especially for Texas.

These recent developments are attributable in large part to the greatly increased demands occasioned by the war, yet it would be a mistake to give this reason for development too much emphasis, for this expansion represents a direct prolongation of trends in chemical growth that were well in evidence during the two intervening decades between World War I and World War II.

This extensive growth is expressed in the development of a host of new products, many of which are already being produced on a large scale by mass-production methods—and back of this, it is to be remembered, was intensive scientific research extending over long periods of time.

It is worthwhile to note also, that the chemical industry will enter the postwar period with its productive capacity not only greatly expanded but also considerably diversified in comparison with the pre-war years.

The chemical industry is primarily a producer of materials rather than of fabricated products or articles for the ultimate consumer. This fact in itself presents a field of vast potentialities for Texas—that of developing fabricating industries using chemical products made in Texas as raw materials for the building up of large fabricating industries to supply finished goods for which already a large market exists.

Furthermore the uptrend in the chemical industry for the United States as a whole will, without doubt, reach a new peak in output in the years following the war. A temporary slump may be expected during a period of readjustment—but as regards conversion problems the chemical industry *per se* is in a highly favorable position and in many lines the peacetime demands will be for the same kind of products as those required for wartime uses.

Individual chemical companies have already laid out programs of expansion designed to meet the increased demands of the postwar period.

As illustrative of this phase of the chemical industry, Monsanto Chemical Company, for instance, has a postwar program calling for an expenditure of $40,000,000 during a five-year period; Monsanto's expansion program consists of four phases of development, covering 112 projects. Of the phases or divisions, a Monsanto official stated recently that Organic Chemicals and Plastics will receive a good share of attention. One of Monsanto's most rapidly growing divisions is plastics—a field that is rapidly widening owing to the development of new and improved types as well as to greatly expanded capacity called for by the war program. It is to be expected also that existing markets will be considerably expanded due to price reductions as large-scale mass-production operations get under way.

The modern organic chemical industry is an industry built primarily upon the manufacture of synthetic products; gases of various sorts play a predominant part as raw materials in the various fields of synthesis which in the past few years have achieved such conspicuous success.

The manufacture of synthetics, however, is by no means limited to organic materials, as witnessed for instance, in the applications of chlorine that have become so outstanding in the past few years—in the field of chlorinated hydrocarbons, carbon tetrachloride, for example, or ethylene dichloride used in making Thiokol synthetic rubber; another is the field of nitro-paraffins, and still another is the newly developing field represented by the silicones, to mention but a few of the outstanding lines of research and industrial developments in these fields.

Apparently, as exemplified and suggested in the present trend in the manufacture of synthetic organic chemicals, major raw materials will comprise *acetylene*, *ethylene*, and *propylene*, together with butane and butylenes.

Ethane and propane, and perhaps butane as well, will be used in increasing quantities for the production of these chemical components, due to availability of suitable processes for fractionation, separation and purification, as well as in the field of conversion.

Butane also will be required as a raw material, for the production of isobutane through isomerization.

These trends together with the chemical potentialities of these hydrocarbons, which belong to the aliphatic group (in contrast to the aromatics), serve to re-emphasize the fundamental importance of Texas' petroleum and natural gas resources. The inherent nature of petroleum and natural gas as natural mixtures of organic chemical compounds has given these natural resources their vast importance in three broader lines of utilization:

a) As fuels, including the various types of motor fuels, industrial fuels, embracing a large variety of special metal-treating processes, and the like;

b) As a source from which hydrocarbons can be obtained for conversion into intermediates suitable for the synthetic organic chemical industry;

c) As a source of elemental carbon (carbon black, for instance) and of hydrogen, important for further syntheses.

Some Modern Chemical Processes

At this place it is appropriate to outline briefly some of the processes which have been so important in these more recent developments of the chemical industry. It is surprising to note, first of all, that many of the fundamental discoveries which have since proven so significant were made in the 19th century; for various reasons, they began to be applied commercially on a large scale only by the turn of the century, and many of them have become of outstanding importance only in the past decade or so. This is another way of saying that much of the remarkable displays of technologic progress of the 20th century was built upon the scientific developments of the 19th century. The great developments of the present century were made possible by the fact that the world was technically prepared for them. It may not be repetitious to state again that one of the greatest accomplishments of the 19th century was scientific research—an exemplification of the scientific method, as against special pleading, or just manipulating certain facts to prove a point.

Polymerization was used as early as 1839. Benjamin Silliman of Yale wrote a paper in 1855 dealing with thermally decomposing heavier hydrocarbons of crude petroleum to yield lighter hydrocarbons; the French chemist, Berthelot had in 1867 successfully reacted ethylene with benzene to form styrene. In 1873, Prunier cracked a petroleum distillate thereby producing isobutylene. And long before that in 1809 Dalton had shown that methane could be decomposed to carbon monoxide and hydrogen by an electric spark, and the immortal Faraday, who has been called the greatest scientific experimenter of all time, had also dealt with high-temperature conversion of hydrocarbon gases. But thermal cracking of petroleum did not become commercially important until the work of Burton about 1912—just before World War I.

An outstanding advance in new methods, however, was that inaugurated by Sabatier. As E. E. Slosson has written: "The veteran French chemist, Professor Paul Sabatier, of Toulouse, opened the door to the new era with the key called 'catalysis' . . ." Shortly after the turn of the century "he found that hydrogen gas could be made to unite with carbon-monoxide gas in the presence of finely divided nickel and produce methane."

This is in principle the same reaction later employed in the Fischer-Tropsch process for producing liquid hydrocarbons via the water gas reaction, in which the raw materials are carbon monoxide and hydrogen, except that the latter process uses lower temperatures whereas Sabatier was obliged to use higher temperatures, owing to the lower reactivity of the catalyst available to him at the time. It may be noted parenthetically that research in catalysts, together with the development of new catalysts during the past two decades, has become a large field in itself. Water gas, a mixture of carbon monoxide and hydrogen, is made by passing superheated steam over very hot coke. More recently water gas is also made by reacting steam and natural gas, which supplies raw materials for the synthesis of liquid hydrocarbons from methane.

In this connection, Fritz Haber's research work on high-pressure synthesis of ammonia which was brought to a successful conclusion by 1913 is in one sense a continuation of the work begun by Sabatier years previously.

In the middle 1920's came the announcement of Bergius' success in the hydrogenation of coal to yield petroleum substitutes suitable for motor fuels.

It was not until the middle 1930's that after years of research work Eugene Houdry's efforts came to be successfully applied to catalytic cracking of heavier petroleum fractions, thereby leading the way to the widespread revolutionary procedures in petroleum refining which have been so vitally important in World War II.

Along with these revolutionary advances, which upon close examination appear little less than spectacular, are a series of more commonplace yet essential and highly significant processes pertaining to precise fractionation and separation of gases rendering these gases available individually not only in large quantities but also in an exceptional high degree of purity. Without these complementary developments much of the results of cracking, catalytic conversion, and synthesis would be greatly limited and circumscribed.

Summing up, the petroleum and natural gas chemical industry may be considered under four categories:

1) First of all the sources of the basic materials. The sources of the aliphatic hydrocarbons are petroleum and natural gas. Petroleum is a complex mixture made up essentially of liquid hydrocarbons (of widely different boiling ranges) in which both gaseous and solid hydrocarbons are dissolved. Certain crude oils are rich in the naphthene series of hydrocarbons—those with closed chains, and which are designated as alicyclic hydrocarbons.

The following statements in general apply to crude oils of the United States. The parafinnic crudes, the so-called paraffin-base oils, characterize the oil of the Appalachian region, Michigan, as well as certain areas of southern Arkansas and northern Louisiana.

The naphthenic or asphalt crudes occur mainly in the heavy oils of the Gulf Coast of Texas and Louisiana and of California.

The Mid-Continent oils are of a parafinnic- and mixed-base types.

Natural gas consists of a mixture of gaseous hydrocarbons of the paraffin or methane series, in which methane is the predominant one. Methane, ethane, propane, and butane—lower molecular weight paraffin hydrocarbons—not only comprise the bulk of natural gas but these gases occur also in solution in most crude oils. Recovery from natural gas of its heavier hydrocarbons—from 4 to 8 carbon atoms—yields natural gasoline, which also contains substantial amounts of ethane and propane.

The hydrocarbons of dry natural gas all belong to the paraffin group. Crude oil, on the other hand, may have

either a paraffin or a naphthenic base, or it may be of the mixed-base type.

It is generally considered that olefin hydrocarbons do not occur naturally in petroleum. This group of hydrocarbons consists of products of chemical conversion.

Of the fundamental compounds derivable from oil and gas, certain ones, such as propylene, ethylene, and acetylene, for instance, stand out in a conspicuous manner.

2) At the other end of the series comprising the petroleum chemistry industry are the final materials which are far removed from the hydrocarbons contained in petroleum and natural gas as well as from those hydrocarbons formed by conversion of the naturally occurring ones.

These final products of the chemical phase of the industry fall into several broad groups, such as synthetic fibers as well as fiber and textile finishing agents, synthetic rubbers, synthetic resins and plastics, aviation gasolines, together with a wide list of processing substances such as solvents, plasticizers, and detergents.

3) Then there are the various and complex intermediate products in the series—the substances which lie between the fundamental hydrocarbon compounds in oil and gas and the finished materials. In these steps, certain intermediates may be considered as representing key materials—the products of salient stages in the sequence of operations from raw material to the final product.

4) Finally, there are the methods, most of which are complex and intricate, whereby the fundamental hydrocarbon compounds are converted into the various intermediates, together with the processes employed in manufacturing the finished materials from suitable intermediates. In general, these methods embrace, on the one hand, the breaking down of naturally occurring hydrocarbon fractions through thermal or catalytic cracking, and, on the other hand, the synthesis of new materials from the gaseous substances formed by cracking and/or the naturally occurring gaseous hydrocarbon compounds. The synthesis of new materials is accomplished by a number of processes, the names of which have come into fairly common use only in the past few years; among the more commonly employed processes of this type are polymerization, alkylation, hydrogenation, to which isomerization and dehydrogenation may be added. In addition to cracking and synthesis processes are the refined methods of fractionation, precise separation, and purification, noted elsewhere in this article, and which also have come into wide use during the past few years.

Acetylene

Of the 5 or 6 more prominent of the hydrocarbon gases, acetylene has the longest industrial history. This gas was discovered by Davy in 1836 and was named by Berthelot in the early 1860's. Wöhler in 1862 found that acetylene could be produced by the action of water on calcium carbide but the commercial application of this process had to await a lower-cost means of obtaining calcium carbide commercially, which came three decades later as one of the applications of the electric furnace and which in turn could not have been a practical proposition until it was commercially possible to produce electric current in large blocks.

These facts regarding carbide-derived acetylene have not essentially changed to the present day. Electric power is the largest single item in the cost of calcium carbide and therefore of carbide acetylene. Plant location for the manufacture of calcium carbide is limited to localities where electric power is low in cost as well as adequate in amount.

The consequence has been that the production of acetylene has grown up under the wing of other industries and its manufacture has been limited almost entirely to older industrial regions; this is particularly the case in northeastern United States as well as in Germany. And, in these older industrial regions, acetylene production apparently partakes to a considerable degree of the nature of a vested interest.

As early as 1894, Lewes converted ethylene to acetylene in thermal cracking operations but the resulting yields were small. This was just at the time when the production of carbide acetylene was getting a substantial start and with the rapid progress made in this industry, but little was heard of conversion processes in making acetylene from other gases for several years.

Since World War I, however, considerable attention has been given the problem of economically producing acetylene from other hydrocarbon substances. These methods are concerned with the cracking of hydrocarbons by the electric arc, the silent electric discharge, and thermal cracking, especially in regenerative furnaces. The hydrocarbons used as raw material include gas, oil, methane, and propane, or mixtures of hydrocarbons.

Wulff's studies in straight thermal cracking of hydrocarbons to produce acetylene were begun in 1926. For some years following 1934 Tennessee Eastman Corporation carried on work in an attempt to improve and commercialize the Wulff process.

Dr. E. P. Schoch began his studies at The University of Texas on the use of the electric discharge method to produce acetylene from natural gas in 1928. Dr. Schoch's work revolves about the possibilities of producing acetylene economically from methane, the latter being the predominant hydrocarbon constituent of natural gas. In this connection, Gustav Egloff wrote in 1942: "Methane is the most difficult of the hydrocarbons to convert into something else cheaply. You can do anything at a price. As a matter of fact, if you start with methane gas alone you can produce all the synthetic products that man has produced in organic chemistry, and there are over 300,000 different ones, that may be utilized as fuels, lubricating oils, fatty acids and many others too numerous to mention. The hydrocarbon is there waiting to be converted into the manifold products that man requires in modern civilization."

It may be noted that the German synthetic rubber industry is based principally upon the use of carbide acetylene, which, of course, is a coke derivative. Germany is relatively rich in coal but has always been

lacking in petroleum and natural gas. Per K. Frolich wrote in 1943: "As far as known, acetylene and not fermentation alcohol is the starting material for Germany's Buna-S production. This acetylene is obtained partly from calcium carbide, made from lime and coke, and partly from high-temperature cracking of methane and other hydrocarbon materials."

The acetylene is converted to butadiene through a series of steps in what is designated as the aldol process—a process that apparently was worked out by Russian chemists during the period from around 1900 to the beginning of World War I, and which has been applied in Germany in large-scale production of butadiene for synthetic rubber manufacture.

In the United States, only one type of synthetic rubber is being made from acetylene derivative—Neoprene—and although Neoprene is a high quality synthetic rubber, the high costs of this substance preclude its use except for specialty applications in the industrial field.

Thus far, too little progress seems to have been made in obtaining acetylene commercially in large quantities from petroleum or natural gas hydrocarbons. The acetylene in the war program apparently is largely made by the high-cost calcium carbide process.

In *The Oil and Gas Journal*, of March 25, 1943, C. R. Wagner summed up the situation as follows: "Small quantities [of acetylene] always turned up in high-temperature processes to plague operators with a separation problem, but no commercial units were installed. A few years ago Tennessee Eastman Corp. carried on a long series of experiments with the Wulff process, and today a plant to produce 150,000 lbs. of acetylene per day is being installed by a large chemical company . . .

"The reactor is a regenerative type heater in which the refractories are spaced so as to give very high gas velocities during the 'make' period. A considerable volume of steam at low pressure is used to maintain a low partial pressure of the acetylene produced. The feed employed may be anything from ethane up to kerosene. Ethylene produced in the process is recycled in order to increase the yield of acetylene, and its concentration in the exit gases.

"It is difficult to predict what may be the effect of such a commercial venture as this acetylene making unit. If it has a long enough operating history before the war ends to demonstrate its ability to make cheap acetylene, future installations may well be of this type. On the other hand, unless it is able to compete with existing units in the postwar period, it may succumb to cheap electricity and the inertia of an established industry."

Prior to World War I, acetylene in the United States, at least, was used mainly as an industrial gas where its heating value had a wide variety of applications. During World War I Germany made a synthetic rubber derived from acetylene on the basis of research carried out during the previous decade in Russia. In the 1930's Germany developed the Buna-S type of rubber using acetylene as the starting material. In 1934, quoting from L. F. Marek, *Petroleum Refiner*, October, 1942, "the American consul at Frankfurt am Main reported the existence of two plants, one at Huls to use electric arc cracking of residues from synthetic gasoline plants to produce acetylene, and one at Schokopau to use acetylene derived from carbide."

In the upsurge in this country of the chemical industry which got its impetus in World War I, acetylene came to be used in the United States for the production of acetone, acetic acid, and acetic anhydride, from which in turn are derived a host of organic chemicals, and which by that time were getting under production in the United States.

Du Pont in the early 1930's developed Neoprene synthetic rubber using acetylene as the starting material. Neoprene is a polymerization product from chloroprene.

With the growth more recently of a new group of synthetics, the vinyl resins, acetylene has achieved a new importance, in the manufacture of vinyl acetate, vinyl chloride, polyvinyl alcohol, and polyvinyl butyral. Vinyl acetate is made by reacting acetylene and acetic acid. Vinyl chloride can be derived from either acetylene or ethylene.

Polymerizing of vinyl acetate and vinyl chloride yields the most common of the "vinylites," the synthetic filament or fiber form of which is "vinyon."

For the manufacture of this highly important group of vinyl plastics and fibers, the basic raw materials are acetylene, ethylene, acetic acid, and chlorine; all of these except chlorine are obtainable from petroleum hydrocarbons.

Ethylene

Ethylene, like acetylene and butylene as well, is a gas that has long been known. Like butylene and propylene, its industrial uses, however, have come only rather recently.

In the early 1930's the demand for ethylene began to be industrially important owing to its utilization for the manufacture of ethyl alcohol and ethylene glycol, as well as in the making of tetraethyl lead. At first it was thought that the supply of ethylene might be furnished as a by-product gas from normal vapor-phase cracking refinery operations. In fact, ethylene like propylene had long been considered as waste refinery gas. But as the demand grew not only in volume but also as to purity of the product, the difficulties of separation of ethylene from other hydrocarbons in the mixed refinery gases proved difficult at this state of development, and new means were sought for producing ethylene as a direct product.

Ethylene for chemical synthesis is now produced by cracking propane, present in large quantities in the residue gas from natural gasoline plants, or by cracking gas oil in special high-temperature operations.

Ethylene glycol, which is used in an antifreeze long familiarly known as "Prestone," was first made in 1925. Ethylene glycol, however, is also an intermediate used, for example, in the manufacture of synthetic resins of the alkyd type, as well as in making processing chemicals.

In the late 1930's Ethyl Corporation built a large plant at Baton Rouge, Louisiana, for the production of tetraethyl lead.

A large plant has been built at Baton Rouge for the manufacture of ethyl alcohol from ethylene. To provide the ethylene, two large-scale ethylene producing plants have been built in connection with the refinery of Standard Oil Company of Louisiana.

Ethylene alkylated with isobutane yields neohexane, a blending agent used in preparing aviation gasoline.

Ethylene is now required in large quantities for the manufacture of styrene, the lesser component, or co-monomer used in the production of GR-S synthetic rubber. Alkylation of ethylene with benzene yields ethylbenzene, which upon being dehydrogenated gives styrene. Ethylbenzene is also important as an ingredient for making blending agents used in aviation gasoline, and excess production from the synthetic rubber program is so used. The output of polystyrene plastics will undoubtedly be greatly expanded after the war. Ethylene is also used in making ethylene dichloride, for the manufacture of Thiokol synthetic rubber. It likewise is required in the production of polyethylene plastics as well as in the production of vinylidene chloride. Vinylidene chloride is made from ethylene and chlorine; the polymer of vinylidene chloride, polyvinylidene chloride, is "saran" which was introduced by Dow Chemical Company in 1939.

Polyethylene, or polythene, is produced by high-pressure polymerization of ethylene. First made by Imperial Chemical Industries, Ltd., about 1941, it is now being made in the United States by two chemical companies. DuPont began producing polythene in 1944 using the process developed by Imperial Chemical Industries. It is also produced by Union Carbide and Carbon Corporation through Linde Air Products Company by high-pressure synthesis, but by a process different from any other commercial process for making polyethylene.

Either ethylene or acetylene can be used in making vinyl chloride or vinyl acetate, the intermediates for the production of synthetic resins of the vinyl group. In the production of vinyl acetate, acetylene, however, is commonly used.

Either ethylene or acetylene may be used as the starting material for making acetic acid. In the case of ethylene, it is converted to ethyl alcohol from which acetaldehyde is obtained; from the latter substance, either acetone or acetic acid may be obtained.

Another plastic which uses ethylene in its manufacture is ethyl cellulose. In this case, ethyl chloride (derived from ethylene and hydrogen chloride) together with sodium hydroxide, is reacted with cellulose. Ethyl cellulose is a plastic of considerable promise and one to which Texas should give attention.

Propylene

Propylene, like ethylene, is one of the light olefin hydrocarbons. Propylene is available in large quantities from catalytic cracking operations.

Propane upon being subjected to cracking operations yields propylene as well as ethylene, together with hydrogen, methane, ethane and certain other hydrocarbons.

Isopropyl alcohol is made from propylene. Isopropyl alcohol, important as a solvent and as an antifreeze, is also widely utilized as a chemical intermediate. By catalytic dehydrogenation, isopropyl alcohol yields acetic acid as well as acetone; acetic anhydride can be produced from acetone. All of these substances are required in acetate rayon production. Acetone is important as an intermediate in the manufacture of methyl methacrylate plastics. Large amounts of acetic anhydride is required in the production of cellulose acetate; the achievement of large-scale production of acetic anhydride from propylene was an important factor in the increased production which characterized cellulose acetate in the late 1930's. Acetic anhydride may also be produced from acetylene.

Propylene, alkylated with benzene, yields cumene, an ingredient in blending agents for aviation fuel.

Allyl chloride is made by chlorination of propylene; allyl chloride, which can be made in quantity, is an intermediate for the manufacture of allyl alcohol. Allyl alcohol is used as a starting material for making the new allyl synthetic resin, CR–39, or Allymer–39, as it is now designated.

Besides allyl resins, resins of the acrylic type are also derived from propylene.

Shell Oil Company has under construction at its Deer Park refinery on the Houston Ship Channel a million dollar unit for the production of allyl chloride and allyl alcohol to be made from propylene. Shell Chemical Company announced late in February, 1945, that this new plant is expected to be in production by April, 1945. These chemicals will be suitable for conversion into numerous sorts of materials, including such substances as low-pressure laminating and casting resins, surface coatings, pharmaceuticals, as well as chemical intermediates.

Butylenes

Isobutylene was discovered by Faraday in 1825. In 1873 Prunier prepared isobutylene by cracking a petroleum distillate called ligroin. In 1887 Scheschukow reacted isobutylene with dilute sulphuric acid, ultimately obtaining tertiary butyl alcohol.

It was not until about the period of the middle 1930's that the American chemical industry became interested in butylenes. About 1935 Standard Oil of New Jersey chemists became interested in butylenes as a source material for making butyl alcohol and methyl ethyl ketone, both of which are solvents. For a short time the supply of butylenes, as was also the case for ethylene, from normal cracking refinery operations, was ample. But, as was also the case with ethylene, the demand soon outgrew this means of supply.

The next step was the cracking of light gas oils followed by the inauguration of intricate and extraordinarily effective procedures for separation and purification. But when the synthetic rubber program came along, and with the decision that the large share of synthetic rubber, GR–S, is to be produced from butadiene and styrene, the vast requirements for butylene (which upon dehydrogenation yields butadiene) rendered this supply of butylene hopelessly inadequate.

For a time, it was considered that butylene could best be supplied through the dehydrogenation of natural gas butane. But by 1940, fortunately the development of catalytic cracking refinery operations was taking shape in the oil industry; in a short time, catalytic cracking became a revolutionary means of providing supplies of high-octane aviation fuel and at the same time, it could supply sufficiently large quantities of butylenes for conversion to butadiene to make this source of butylenes of key importance in the synthetic rubber program.

Catalytic cracking operations yield large volumes not only of butylenes but also of butanes, propane, propylene and amylenes. Butylenes are produced in thermal refinery operations, but catalytic cracking yields them in far greater volume.

But it was not until late in 1941 that a suitable catalyst, together with project designs for converting normal butylenes to butadiene, was available. This process is used now to supply about 62 per cent of all the butadiene from petroleum in the synthetic rubber program.

Isobutylene is also produced in cracking refinery operations. Isobutylene is used in making aviation alkylate, the main blending agent in aviation gasoline; copolymerized with small amounts of isoprene, it is used in making Butyl synthetic rubber.

Butane and Propane

Normal butane is ordinarily available at refineries in ample quantity; it is also one of the important gases derived from natural gasoline plants, the latter group of products being referred to as liquefied petroleum gases, or in abbreviated form, LPG. Butanes are produced in refineries in topping operations as well as through thermal and catalytic cracking.

Butane can be converted to butylene which in turn can be converted to butadiene for making GR–S synthetic rubber. More important, however, is its conversion to isobutane, through the process known as isomerization. Isobutane is produced from both thermal and catalytic cracking, but not in amounts sufficient for alkylation with the olefin hydrocarbons available from these sources for the production of aviation alkylate. Normal butane is relatively plentiful and it therefore is converted to the more suitable form, isobutane. Isobutane alkylated with olefins, butylene, for instance, or amylenes, yields aviation alkylate—the key material in the production of blending agents in the manufacture of aviation gasoline. The amylenes, produced by cracking operations, are alkylated with isobutane, in order to divert butylenes for conversion either to butadiene or to codimer; the latter upon being hydrogenated yields hydrocodimer, an ingredient of blending agents used in aviation gasoline. Codimer is the result of copolymerizing normal butylenes and isobutylene.

Possibilities of propane and normal butane as raw material for chemical conversion are briefly summarized by Oberfell and Thomas in *The Oil and Gas Journal*, January 6, 1945: "Propane and normal butane are relatively nonreactive chemically but research has shown that they may be processed to produce substances of high chemical reactivity. LPG, for example, may be cracked to yield ethylene, acetylene, propylene and other substances. To these unsaturates all manner of chemical reagents may be added to produce myriads of useful new compounds. For example, ethyl alcohol is produced by chemical synthesis of water and ethylene. Other products from ethylene include ethylene glycol which is widely used as an antifreeze as well as a source for the production of important chemical raw materials, solvents and plastics. The possibility for production of both old and new organic chemicals from light-hydrocarbon raw materials are indeed most intriguing and almost without limit as to number."

Availability of Hydrocarbons

The war program has crystallized attention upon the availability in large volume of the individual hydrocarbon gases noted above, and well it may have, as these substances have proven vital in the war effort. But that is not the whole story by any means. All of these compounds will be available for chemical synthesis in the postwar years. Motor fuels of the future, and lubricating oils only perhaps less so, will utilize new chemical procedures that have proven economical in the war program. In other words, the conventional bulk products of the petroleum refining and natural gasoline plants will be subjected to changes and modifications wrought by advances in the chemical knowledge and handling of their ingredients.

But the chemical industry, *per se*, stands to profit most from the availability in adequate volume particularly of such gases as propylene, ethylene, isobutylene, butene-1, butene-2, as well as normal hexane and normal heptane.

Chemical manufacturers during the past few years have been increasing their consumption of the light hydrocarbons from petroleum, and many of the oil companies have done likewise. Perhaps most people have some idea of the developments made by Carbide and Carbon Chemicals Corporation, Dow Chemical Company, and Monsanto Chemical Company in these lines, but the research and development work done by oil companies as Standard Oil of New Jersey, Shell Oil Company, Phillips Petroleum Company is perhaps less well known and appreciated. It may be noted here that the Texas City plant of Carbide and Carbon Chemicals Corporation was set up to utilize light gases—C_2 and C_3 hydrocarbons—for chemical conversion, and which are supplied by the near-by refinery of Pan-American Refining Corporation.

In some refineries, for instance, the catalytic light ends from catalytic cracking units are fractionated into groups: the so-called C_4 cut goes to the butadiene plant, or the isobutylene removed from it may go to a Butyl synthetic rubber plant; the C_3 cut is sent to a polymerization unit; and the cut of the lightest group, consisting entirely of methane, ethane, and ethylene may be used only as refinery fuel.

Late in 1944, American Cyanamid Company and the Texas Company formed a jointly owned subsidiary, the Jefferson Chemical Company, to engage in the manufacture and sale of chemicals from petroleum. The chairman of the Texas Company, W. S. Rogers, stated at the

time: "Great strides have been made in this field during the war. Many constituents of petroleum gases which were formerly by-products at oil refineries are now in demand as raw materials. We have, therefore, established Jefferson Chemical Co., Inc., to explore this field and produce from petroleum and petroleum gases such chemicals and chemical products as are likely to be in demand by various consuming industries." It was reported in February, 1945, that Jefferson Chemical Company will operate a $20 million plant at Port Arthur, Texas, for the conversion of waste petroleum products into chemicals. This announcement has not as yet been confirmed by company officials.

Chief among the better known products these concerns are manufacturing from these gases are a wide range of industrial alcohols, glycols, acetaldehyde, acetic acid, acetic anhydride, carbon tetrachloride, butadiene, and so on. As summed up by C. R. Wagner in *The Oil and Gas Journal*, March 25, 1943: "Whatever may be the economic value of the particular units now being operated or installed to produce war materials, we can be certain that our industry is advancing in technical developments as it never has before, and that we shall see a chemical industry of unprecedented size grow out of these developments.

"The technique which is making possible the large scale production today of such products as isobutylene, butene-1, butene-2, butadiene, isoprene and acetylene will scarcely fail when peacetime industry demands these and countless other organic chemicals as raw materials for the synthesis of products to fill needs of which we are today unaware."

Still another summary is represented from the concluding statements of J. H. Boyd, Jr., Phillips Petroleum Company as reported in *Chemical and Engineering News*, February 25, 1945, in an article entitled "Petroleum: Source of Raw Materials for Chemical Industry": "It is clear that petroleum offers the organic chemical industry a wealth of new raw materials for organic synthesis. The supply of pure hydrocarbons is potentially large. Techniques for their separation are already in commercial use but their development is far from complete. Insistence on high purity increases the cost of the hydrocarbons and this penalty is greater the higher the average molecular weight, owing to the greater complexity of the mixture from which it is recovered and the increasing processing required to effect the separation. Petroleum by-products cannot be held uniform in quality and warranted as to continuity of supply and be available on a distress price basis. . . . Today 17 hydrocarbons are being produced and shipped in commercial quantities; all but three are of high commercial purity. Some are naturally occurring hydrocarbons, but many are synthesized to meet the needs of the war aviation gasoline and synthetic rubber programs. While current supply may be tight, in general chemical needs carry sufficient priority to release them for such application. Postwar additional hydrocarbons will be available and organic chemical industry can write the ticket if it is prepared to pay the price."

Liquefied Petroleum Gases

An important source of hydrocarbons is natural gas. Besides natural gasoline, the natural gasoline industry produces from natural gas a number of light hydrocarbons that together are designated as liquefied petroleum gases, and which include propane, normal butane, isobutane, normal pentane and isopentane as the main constituents. Major components of LPG most important in chemical manufacture are propane and the butanes-butylenes mixtures, although normal butane and butane-propane mixtures are also used, but in lesser amounts. The use by chemical companies of these hydrocarbons supplied from natural gas has grown up only in the past few years, but without question the utilization of liquefied petroleum gases for chemical manufacture will be increasingly important in the postwar period.

In 1943, a total of 110,895,000 gallons of LPG, as a liquid, was used as chemical raw materials. The 1944 requirement for this market was set at 159,788,000 gallons—an increase of 55 per cent.

But still larger amounts of these gases were delivered in gaseous form by pipelines to chemical plants. For 1943, the total estimated amount of LPG used as chemical raw materials, delivered as liquid or gas, is placed at 389,127,500-gallon equivalent. The 1944 requirement was placed at a 578,022,000-gallon equivalent. As summarized by P. K. Thompson, *Petroleum Refiner*, February, 1945:

"During 1943, natural gasoline and cycling plants produced 4,050,000 barrels of isobutane and 19,650,000 barrels of other liquefied petroleum gases. During that year 4,060,000 barrels of similar gases, 'refinery gases' were recovered at petroleum refineries. These figures no doubt were considerably increased in 1944 as many new natural gasoline and recycle condensate plants were completed during the year.

"This chemical use of LPG continues to grow with the prediction of ever-increasing amounts of ethane-propane and propane-butane mixtures as raw material in processes employing regenerative cracking and catalytic oxidation, respectively."

Late in 1944, Petroleum Administration for War in one month authorized three projects for the installation of ethane-propane fractionating towers at recycling plants in California in order to supply some of the major chemical plants in that State which are making such chemicals as alcohols, glycols, acetaldehyde, carbon tetrachloride and perchloroethylene.

In addition, during that same month at least four major chemical and plastics producers made inquiries of PAW as to further supplies of ethane-propane mixtures.

Availability of increasing amounts of light hydrocarbon fractions for LPG products apparently is insured for a considerable time by:

1. New discoveries of natural gas and gas condensate fields;
2. Further extensions in catalytic-cracking operations;
3. Added to these factors is the application of modern extraction and separation procedures.

Ample propane supplies exist at production sources. There is a possibility that propane rather than butane will be the key component for chemical manufacture in the immediate future. As regards this possibility, P. K. Thompson wrote as follows in *National Petroleum News*, Technical Section, March 7, 1945:

"In analyzing this situation, it must be pointed out that with the return to normal times the large quantities presently going into war material can be made available for peacetime uses. Too, we are now passing from an era of moderate thermal cracking into one in which intensified catalytic operations will predominate. Thus, where butane has been necessary to produce propylene in moderate thermal cracking, catalytic dehydrogenation will permit the use of propane as charging stock when the perfection of a satisfactory separation process is developed."

Hydrogen from Natural Gas

Elemental hydrogen, for ammonia synthesis, can be obtained from natural gas either by high-temperature cracking in regenerative furnaces, or by the catalytic-methane-steam reaction. Natural gas is considered the most economical source of hydrogen. Hydrogen is a constituent of refinery gases; it is also produced as a by-product from toluene and butadiene plants. Hydrogen is also supplied as a by-product of the electrolysis of aqueous solutions of sodium chloride. Uses of hydrogen other than in ammonia synthesis, include hydrogenation (hardening) of fats and oils, hydrogenation of certain hydrocarbons, as well as in making hydrogen chloride.

Ammonia Synthesis

At least three of the nine synthetic ammonia plants in the government program use natural gas as the source of hydrogen raw material. One of these is the new Mathieson-operated ammonia plant at Lake Charles, Louisiana, which went into production in September, 1944. The other ammonia plants owned by the Defense Plant Corporation using natural gas as the source of hydrogen include one in southern Arkansas operated by Lion Chemical Company and one at Sterlington, Louisiana, operated by a subsidiary of Commercial Solvents Corporation.

Other than its use in the manufacture of nitric acid, which currently is its outstanding use, ammonia is used in the preparation of ammonium nitrate for explosives and of ammonium sulphate and ammonium phosphate for fertilizers. Ammonia reacted with formaldehyde yields a powerful explosive used in "block-busters."

Ammonia is a required process chemical used in the Solvay alkali process. Ammonia is used as a refrigerant not only in conventional refrigeration and quick freezing but also industrially, as, for instance, in petroleum refining processes, in the production of certain synthetic rubbers, in nitriding of steel, and also provides the "controlled atmosphere" for various annealing processes used in making certain kinds of electrical equipment. Ammonium chloride is the more familiar sal ammoniac used in dry cell batteries.

Interaction of ammonia and carbon dioxide yields urea, a raw material for the urea resins and also utilized as a fertilizer; urea is a raw material for making substances used in treating textile fabrics, and more recently it has been used to make a highly concentrated protein cattle feed.

Alcohol Synthesis

Wood alcohol, or methanol, is currently made mostly by high-pressure synthesis of hydrogen and carbon monoxide by direct union in the presence of a suitable catalyst. In an article written in 1942 by members of the Coal Research Laboratory of the Carnegie Institute of Technology occurs the following statement: "The greatest utilization of coal in purely chemical production in this country is carried out through the alcohol synthesis by the duPont plant at Belle, West Virginia. In this case the carbon monoxide and hydrogen (from the water gas process) are caused to react together in great catalytic converters at elevated temperatures and pressures to form alcohol."

The equipment used in making synthetic methanol by this process is the same as that used in making ammonia by high-pressure synthesis, and the plant equipment can therefore be used interchangeably. This means that those synthetic ammonia plants which will not be needed in the postwar years can and some of them no doubt will be converted to the production of methanol.

Methanol was first prepared synthetically in the United States in 1927. It can be produced by two processes—by the process noted above, which is the catalytic hydrogenation of carbon monoxide, and by the controlled oxidation of methane. Largest pre-war use of methanol was in the production of formaldehyde.

Isopropyl alcohol made from propylene became available as early as 1920 when it was first made by Standard Alcohol Company.

Ethyl alcohol was first made synthetically in the United States in 1931. In 1937 ethyl alcohol was being made synthetically by Carbide and Carbon Chemicals Corporation at South Charleston, West Virginia, through hydration of ethylene. In 1943, Standard Alcohol Company in a joint venture with an affiliate, Standard Oil Company of Louisiana, began the production of ethyl alcohol synthetically at Baton Rouge, Louisiana, also by the hydration of ethylene. Commercial Solvents Company operates three ethyl alcohol plants, two in Louisiana, the third on the West Coast.

Uses for ethyl alcohol are numerous; its largest pre-war field of consumption was in the cellulose industry. Synthetic alcohol is being produced at Texas City by Union Carbide and Chemical Corporation; the construction at its Deer Park refinery, near Houston, of a unit to produce allyl alcohol by Shell Oil Company is noted elsewhere in this article.

Plastics

The importance of the rapidly expanding field of plastics, and particularly of plastics derivable from petroleum and natural gas hydrocarbons, is of sufficient importance to warrant their treatment in a special article. Certainly other States are interested in the production

of plastics. The alkyd group of resins may be considered briefly as illustrative of the situation in plastics production. The alkyd resins, although discovered in 1901, were non-existent commercially until 1926; currently they rival the much older phenolic group of synthetic resins both in volume and importance.

Alkyd resins are composed of giant molecules made by reacting glycerol with either phthalic anhydride or maleic anhydride. Phthalic anhydride is made commercially by the catalytic oxidation of naphthalene; maleic anhydride, by catalytic oxidation of benzene. Glycerol is a by-product of soap making but it can be made from propylene.

Demands for alkyd resins currently exceed the supply and three new plants were authorized in the latter part of 1944. Two of these are being built in the Pittsburgh area, one by Koppers United Company, the other by Pittsburgh Coke and Chemical Company. The third plant, to cost a million dollars, will be built at Richmond, California, by Oronite Chemical Company, the chemical subsidiary of Standard Oil Company of California; it may produce phthalic anhydride from petroleum hydrocarbons, possibly by some new process.

Recent Industrial Developments

The utilization of natural gas as a source of hydrogen for ammonia synthesis has been noted. Celanese Corporation of America has a $5,000,000 plant under construction on a 300-acre site near Bishop, Texas. This plant is to produce such intermediates as methanol (methyl alcohol), formaldehyde, acetone, acetic acid and acetic anhydride, from natural gas as the raw material. Propane and butane will be furnished by pipe line from gasoline and recycle plants in adjacent areas. It was announced late in 1944 that the initial planned capacity of this plant will be doubled—and that the products thereof will be sold through the newly organized Celanese Chemical Corporation. Celanese is also constructing at Bishop a 10,000-ton butadiene plant, at an estimated cost of $2,750,000, which will used natural gas constituents as raw material, employing the aldol process. All of these developments are privately financed. The Bishop plant will consume some 80,000 gallons per day of LPG and it will be one of the large hydrocarbon chemical plants in the country.

Dow Chemical Company is building a pipeline from the Katy field near Houston to transport liquefied petroleum gases—ethane-propane mixture—to Freeport to be used as raw materials in chemical manufacture.

It should also be noted that for years Cities Service Oil Company has operated a plant at Tarrant, Oklahoma, for the production of chemicals by controlled oxidation, probably with the use of catalysts, from natural gas. This plant supplies large quantities of methanol and formaldehyde as well as appreciable amounts of acetaldehyde and acetone. In this connection, it was announced a year ago that Monsanto Chemical Company would build a million dollar formaldehyde plant at Texas City. Besides its newer uses, formaldehyde is a necessary intermediate, for the manufacture of the phenol-formaldehyde and the urea-formaldehyde groups of plastics.

Still another phase of natural gas utilization is the possibility of manufacturing liquid petroleum products from these hydrocarbons, which is noted elsewhere in this article.

Natural Gas and Texas Economic Development

The coal resources of Texas even including lignite are of limited quantity in comparison with the great Appalachian district or of the Mid-west region as a whole.

There is general recognition of the strategic position natural gas as an industrial fuel occupies in Texas, not to mention the dependence of Texas upon natural gas as a domestic or household fuel.

A very considerable proportion of the large industries that have arisen in Texas during the past 10 years have been attracted to this State because of our great supplies of natural gas.

The wide potentialities of natural gas as a chemical raw material are less well recognized in Texas and too little attention by far has been given to the broad possibilities Texas possesses for developing huge chemical industries based upon the more elaborate utilization of natural gas for chemical manufacture.

Still another aspect of the natural gas problem is its use for making gasoline by conversion processes—which is not to be confused with natural gasoline production. The following quotation from the *National Petroleum News*, February 7, 1945, summarizes these possibilities as follows:

"Domestic commercialization of the Synthine (Fischer-Tropsch) process, using natural gas as a raw material, has appeared imminent for some time. Reference was made last month to certain reports of such developments and to pertinent figures on the process revealed by R. P. Russell of the Standard Development Company. Another rumored project has been publicized since that date—said to involve the expenditure of 'several million dollars' for a plant to be erected in the Carthage, Texas, gas field.

"More important than any such rumors, however, is a recent announcement of the M. W. Kellogg Company. According to this announcement, a 'new engineering development' makes possible the production of 75-octane gasoline from natural gas for about five cents per gallon, bringing gasoline synthesis definitely within the range of successful commercial operation." This cost is said to be based on natural gas at 5 cents per thousand cubic feet and a plant depreciation of 10 per cent per year. It is further said that 'the gasoline produced can be easily leaded to 80-octane with 1 cc. of tetraethyl lead.'"

In addition, there is the carbon black situation; a serious shortage of carbon black has resulted currently in slowing down tire output from synthetic rubber. During 1944 the War Production Board approved new carbon black plants which were estimated to cost $19,500,000. Most of these will be located in Texas and the Southwest. Early in 1945, the War Production Board announced plans for still further expanding carbon black production.

It was stated in an Associated Press dispatch of March 17, 1945, from Washington that the Defense Plant Corporation had made a preliminary commitment of $1,500,-

000 to Columbian Carbon Company for the purchase of facilities at Seagraves, Texas. The ultimate cost of this carbon black plant is estimated at $2,250,000.

The same dispatch noted that a commitment of $5,000,000 had been made on March 16 to United Carbon Company for plant facilities at Odessa, Texas. The total cost of this project is estimated at around $7,000,000.

It is reported in the March 12, 1945, issue of *The Oil Weekly*, that three pipeline projects by which the Mid-west industrial region will be supplied with an additional nearly 350 million cubic feet daily of natural gas from the Southwest are now taking shape in the Federal Power Commission.

The main lines of these three projects, together with supplemental projects, are estimated to cost close to $100 million. Application for construction permits have been filed with the Federal Power Commission as follows: the Panhandle Eastern Pipe Line Company to increase facilities for delivering approximately an additional 40 million cubic feet daily in Indiana and Ohio; American Light and Traction Company for a big-diameter pipeline to deliver from the Hugoton gas field of southwest Kansas 145.5 million cubic feet daily to Ohio and Michigan; and the Metropolitan Eastern Corporation for an 18-inch pipe line to deliver 140 million cubic feet daily from the East Texas gas field to Ohio.

The latter company, the Metropolitan Eastern Corporation, is a new concern organized for the sole purpose of constructing and operating the 825-mile pipe line from East Texas to Ohio, at an estimated cost of $23,500,000. This gas would be resold to distributing companies in Ohio.

The Oil Weekly article also noted that the Federal Power Commission is scheduled to hold a hearing in Washington on March 21, 1945, to consider Tennessee Gas and Transmission Company's application to construct a 16-inch pipe line approximately 95 miles long to connect the San Salvador field in Hidalgo County, Texas, with the southern terminus of its main transmission line in Nueces County. It was also noted that another hearing was scheduled by the Federal Power Commission for March 26, in Washington, to consider the application of United Pipe Line Company for authority to construct a 24-inch transmission line approximately 142 miles long from its gasoline plant in the Carthage field, Panola County, Texas, to its and Tennessee Gas and Transmission Company's facilities in the Monroe, Louisiana, gas field.

The Mid-west, like the Appalachian industrial region, is a deficit region as regards its own supply of natural gas. Furthermore, demand for fuels in general will increase in these regions, and in neither of them, is there much likelihood that their own production of natural gas can be increased, certainly not to any marked extent. The inference is plain: if these regions are to have the benefits rendered by supplies of natural gas, they must obtain it from other regions. The only practical source for increased supplies is the Southwest and the states of the Southwest in which gas reserves bulk large are Kansas, Louisiana and Texas.

Industrial Manufacture of Catalysts

So important and so diversified have become the requirements for catalysts in modern chemical operations that the manufacture of catalysts has become an industry itself. Texas has three new plants producing catalysts, two of which are operated by American Cyanamid and Chemical Corporation, a subsidiary of American Cyanamid Company. One of these plants, at Fort Worth, and built at a cost of $3,750,000, produces a synthetic "fluid" cracking catalyst which is known as Aerocat; the other plant, at Corpus Christi, and built at a cost of $750,000 manufactures an aluminum chloride catalyst.

Nyotex Chemicals, Inc., is producing anhydrous hydrofluoric acid, also used as a catalyst, at its Houston plant.

The Aromatics

Emphasis in this article thus far has been upon the aliphatic group of hydrocarbons.

That aromatics can be produced from aliphatic type crude oil by conversion is well known. It is possible to convert normal hexane to benzene, and normal heptane can be converted to toluene. Through the process of hydroforming, toluene, an aromatic hydrocarbon, is being produced in large quantities, as a base for high explosives, and with excess production going into aviation gasoline for which it is highly suitable as a high octane ingredient.

C. R. Wagner, writing in *The Oil and Gas Journal*, March 25, 1943, summarized the aromatics problem from petroleum as follows:

"Much has been written about the production of aromatics from n-paraffiins by catalytic processes which simultaneously dehydrogenate the paraffin, cyclize the olefin to a naphthene and dehydrogenate the cyclohexane derivative to an aromatic. Other sources of aromatics are obviously the dehydrogenation of cyclohexanes present in the petroleum and the dealkylation of complex aromatics also present. The selection of suitable catalysts and operating conditions to handle such naphthenes and aromatics may be expected to follow this emergency period. The effect of such a huge production of aromatics from petroleum in the postwar period may be serious to the by-products coal industry. It is difficult to conceive of the possibility that all of these aromatic producing units will be shut down when the war is over. It is equally difficult to imagine a resin and plastics industry large enough to absorb all of the aromatic naphthas which can be made by these plants. . . . The petroleum companies and the organic-chemical manufacturers may well start reflecting on what they can make from cheap aromatics which could not formerly be produced because of raw material cost. Nylon can scarcely be expected to take up all of the surplus!"

In wartime, however, not only do shortages come to exist all along the line, but also the influences of certain stimuli are maximized. Furthermore, some outstanding students who have given considerable attention to the problem have concluded that coal by-products may

not be able to supply the demand for aromatics in the post-war years.

Announcement was made on March 3, 1945, that duPont will build a $22 million plant on a 1000-acre tract on the Sabine River near Orange, Texas, for the production of ingredients used in the manufacture of nylon. The plant will be known as the Sabine River Works; production is scheduled to begin about a year hence. Company officials stated that the nylon ingredients will be made by an intricate chemical process. Nylon is a condensation polymer of the super polymer type; its development by duPont was based on the brilliant research work of Carothers dealing especially with long chain polymers, and whose efforts in developing nylon were successful in 1935. Two intermediates, both of which are derivatives of phenol, are chemically combined in high pressure synthesis to make nylon. Most of the phenol output of the United States is made synthetically from benzene. One of the intermediates of nylon requires ammonia in its production. Nylon is best known as a synthetic silk; it is, however, not a single product, but comprises a whole family of related chemicals designated as polyamides. At least one group of these chemicals can be used as plastics.

In Conclusion

The following quotation is taken from an article "Petroleum's Exciting Future" in *The Lamp*, September, 1944:

> Any "look-aheads" into the future are likely to be far more conservative than the developments that will actually take place. For assumptions are "frozen," based on "know-how" as it exists today. But "know-how" is dynamic, continuously moving forward. From the known processes today will come new ones, so experience tells us, so unheard of, so revolutionary that they will far outrun any possible present speculation.

Elmer H. Johnson.

EMPLOYMENT AND PAY ROLLS IN TEXAS

February, 1945

	Estimated Number of Workers Employed*		Percentage Change		Estimated Amount of Weekly Pay Roll		Percentage Change	
	Jan., 1945[1]	Feb., 1945[2]	from Jan., 1945	from Feb., 1944	Jan., 1945[1]	Feb., 1945[2]	from Jan., 1945	from Feb., 1944
MANUFACTURING								
All Manufacturing Industries	169,999†	169,648†	− 0.2	+ 1.7	$5,943,837	$5,973,445	+ 0.5	+ 8.9
Food Products								
Baking	10,171	10,274	+ 1.0	+22.0	393,110	409,232	+ 4.1	+52.0
Carbonated Beverages	3,260	3,260	± 0.0	− 6.4	97,839	98,723	+ 0.9	− 3.9
Confectionery	1,829	1,791	− 2.1	+ 7.0	24,948	23,973	− 3.9	+ 5.8
Flour Milling	2,517	2,506	− 0.4	+ 4.2	83,729	82,631	− 1.3	+13.4
Ice Cream	1,280	1,325	+ 3.5	+ 1.9	38,219	38,185	− 0.1	+ 6.6
Meat Packing	6,103	5,781	− 5.3	− 7.2	184,338	160,739	−12.8	−15.1
Textiles								
Cotton Textile Mills	5,490	5,560	+ 1.3	+ 0.9	135,629	139,045	+ 2.5	+11.2
Men's Work Clothing	3,854	3,854	± 0.0	−11.2	68,244	71,044	+ 4.1	− 6.2
Forest Products								
Furniture	1,098	1,132	+ 3.2	−32.8	34,884	37,849	+ 8.5	−13.3
Planing Mills	1,752	1,689	− 3.6	−11.8	54,200	54,296	+ 0.2	+ 0.5
Saw Mills	14,502	14,388	− 0.8	− 8.5	257,965	253,684	− 1.7	− 8.8
Paper Boxes	993	993	± 0.0	+13.9	23,315	23,245	− 0.3	+18.4
Printing and Publishing								
Commercial Printing	2,382	2,499	+ 4.9	− 0.6	90,730	93,331	+ 2.9	+ 4.2
Newspaper Publishing	3,850	3,813	− 1.0	− 0.2	113,313	114,870	+ 1.4	+ 5.9
Chemical Products								
Cotton Oil Mills	3,172	3,015	− 4.9	−19.1	59,675	57,603	− 3.5	− 5.7
Petroleum Refining	25,614	25,750	+ 0.5	+ 8.3	1,449,332	1,466,648	+ 1.2	+ 7.2
Stone and Clay Products								
Brick and Tile	1,818	1,800	− 1.0	− 0.6	31,605	30,212	− 4.4	+ 2.0
Cement	727	730	+ 0.5	−23.1	29,569	29,226	− 1.2	−13.9
Iron and Steel Products								
Structural and Ornamental Iron	2,475	2,575	+ 4.1	+ 0.5	84,896	85,918	+ 1.2	+ 4.7
NONMANUFACTURING								
Crude Petroleum Production	28,040	28,300	+ 0.9	+ 6.5	1,578,467	1,565,608	− 0.8	+11.4
Quarrying	(3)	(3)	+ 2.5	+ 9.4	(3)	(3)	− 2.3	+10.9
Public Utilities	(3)	(3)	+ 1.3	+ 1.7	(3)	(3)	− 0.5	+ 1.7
Retail Trade	217,221	213,078	− 1.9	+ 5.4	5,352,508	5,315,930	− 0.7	+13.9
Wholesale Trade	62,066	62,066	− (5)	+ 1.1	2,452,316	2,520,905	+ 2.8	+ 8.1
Dyeing and Cleaning	2,757	3,026	+ 9.8	+ 7.5	72,148	77,572	+ 7.5	+21.8
Hotels	20,029	19,690	− 1.7	+ 2.3	371,487	374,040	+ 0.7	+10.6
Power Laundries	13,612	13,629	+ 0.1	− 3.5	255,361	258,925	+ 1.4	+ 4.9

CHANGES IN EMPLOYMENT AND PAY ROLLS IN SELECTED CITIES[4]

	Employment Percentage Change		Pay Rolls Percentage Change			Employment Percentage Change		Pay Rolls Percentage Change	
	Jan., 1945 to Feb., 1945	Feb., 1944 to Feb., 1945	Jan., 1945 to Feb., 1945	Feb., 1944 to Feb., 1945		Jan., 1945 to Feb., 1945	Feb., 1944 to Feb., 1945	Jan., 1945 to Feb., 1945	Feb., 1944 to Feb., 1945
Abilene	− 1.0	− 0.1	+ 7.1	+ 21.1	Galveston	+ 5.6	− 13.2	− 3.3	+ 6.9
Amarillo	− 1.3	− 16.6	− 0.6	− 4.4	Houston	− 4.0	− 13.6	− 12.1	+ 0.4
Austin	+ 8.1	+ 10.1	+ 6.9	+ 18.5	Port Arthur	+ 1.9	+ 11.0	+ 0.7	+ 6.7
Beaumont	− 2.7	+ 12.2	− 2.7	+ 19.0	San Antonio	+ 1.2	− 2.7	+ 2.1	+ 10.4
Dallas	− 0.6	− 13.2	+ 2.5	− 14.1	Sherman	+ 4.2	+ 28.6	+ 6.5	+ 65.7
El Paso	+ 0.1	+ 4.1	+ 3.8	+ 12.1	Waco	+ 1.7	+ 1.1	+ 7.0	+ 7.6
Fort Worth	− 0.6	− 11.7	− 1.4	− 7.1	Wichita Falls	− 0.3	− 3.7	− 1.3	+ 4.0
Corpus Christi	+ 4.4	+ 15.6	+ 4.5	+ 25.4	STATE	− 1.2	− 6.2	− 3.5	− 2.5

ESTIMATED NUMBER OF EMPLOYEES IN NONAGRICULTURAL BUSINESS AND GOVERNMENT ESTABLISHMENTS[6]

	1942[1]	1943[2]	1944[2]		1942[1]	1943	1944
January	1,170,000	1,385,000	1,429,000	July	1,317,000	1,450,000[1]	1,448,000[2]
February	1,199,000	1,397,000	1,433,000	August	1,352,000	1,441,000[2]	1,446,000[2]
March	1,226,000	1,415,000	1,433,000	September	1,373,000	1,448,000[2]	1,432,000[1]
April	1,222,000	1,433,000	1,435,000	October	1,384,000	1,455,000[2]	1,420,000[2]
May	1,251,000	1,458,000	1,435,000	November	1,389,000	1,461,000[2]	1,434,000[2]
June	1,291,000	1,478,000	1,448,000	December	1,413,700	1,470,000[2]	1,467,000[2]

*Does not include proprietors, firm members, officers of corporations, or other principal executives. Factory employment excludes also office, sales, technical and professional personnel.

†Does not include strictly war industries.

(1)Revised.

(2)Subject to revision.

(3)Not available.

(4)Based on unweighted figures.

(5)Less than 1/10 of one percent.

Not including self-employed persons, casual workers, or domestic servants, and exclusive of military and maritime personnel. These figures are furnished by the Bureau of Labor Statistics, U.S. Department of Labor.

Prepared from reports from representative Texas establishments to the Bureau of Business Research co-operating with the Bureau of Labor Statistics.

Due to the national emergency, publication of data for certain industries is being withheld until further notice.

FEBRUARY SHIPMENTS OF LIVE STOCK CONVERTED TO A RAIL-CAR BASIS*

	Cattle		Calves		Hogs		Sheep		Total	
	1945	1944	1945	1944	1945	1944	1945	1944	1945	1944
Total Interstate Plus Fort Worth	3,368	2,208	519	531	459	1,441	373	228	4,719	4,408
Total Intrastate Omitting Fort Worth	635	541	126	127	26	99	28	27	815	794
TOTAL SHIPMENTS	4,003	2,749	645	658	485	1,540	401	255	5,534	5,202

TEXAS CAR-LOT* SHIPMENTS OF LIVE STOCK FOR YEAR TO DATE

	Cattle		Calves		Hogs		Sheep		Total	
	1945	1944	1945	1944	1945	1944	1945	1944	1945	1944
Total Interstate Plus Fort Worth	7,665	5,061	1,365	1,296	1,113	2,888	956	543	11,099	9,788
Total Intrastate Omitting Fort Worth	1,322	1,055	255	238	58	190	124	100	1,759	1,583
TOTAL SHIPMENTS	8,987	6,116	1,620	1,534	1,171	3,078	1,080	643	12,858	11,371

*Rail-car Basis: Cattle, 30 head per car; calves, 60; swine, 80; and sheep, 250.

Fort Worth shipments are combined with interstate forwardings in order that the bulk of market disappearance for the month may be shown.

NOTE: These data are furnished the United States Bureau of Agricultural Economics by railway officials through more than 1,500 station agents, representing every livestock shipping point in the State. The data are compiled by the Bureau of Business Research.

DAIRY PRODUCTS MANUFACTURED IN PLANTS IN TEXAS

Product and Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
CREAMERY BUTTER (1000 lb.)													
1945*	1,546	1,786											
1944*	1,827	1,984	2,765	3,535	4,008	3,527	3,569	2,792	2,535	2,138	1,549	1,717	32,304
1930–39 average	2,074	2,109	2,392	3,138	3,556	3,166	4,113	2,867	2,513	2,608	2,301	2,211	33,048
ICE CREAM (1000 gal.)‡													
1945*	1,209	1,250											
1944*	991	1,075	1,520	1,687	2,491	2,944	3,200	2,997	2,193	1,897	1,680	1,076	24,011
1930–39 average	215	262	434	570	752	893	904	845	686	460	259	205	6,485
AMERICAN CHEESE (1000 lbs.)													
1945*	779	893											
1944*	762	919	1,229	1,884	2,273	2,159	2,076	1,621	1,372	1,148	869	708	17,197
1930–39 average	554	590	737	1,050	1,215	1,129	1,119	1,025	866	852	718	641	10,496
MILK EQUIVALENT OF DAIRY PRODUCTS† (1000 lbs.)													
1945*	57,308	63,892											
1944*	59,584	65,602	92,663	119,889	144,977	137,502	140,357	115,184	97,137	82,777	63,531	57,455	1,190,864
1930–39 average	54,675	57,139	67,456	89,641	104,323	97,562	97,075	89,185	76,165	73,444	60,119	55,872	922,656

*Estimates of production made by the Bureau of Business Research.

†Milk Equivalent of Dairy products was calculated from production data by the Bureau of Business Research.

‡Includes ice cream, sherbets, ices, etc.

NOTE: 10-year average production on creamery butter, ice cream and American cheese based on data from the Agricultural Marketing Service, U.S.D.A.

FEBRUARY, 1945, CARLOAD MOVEMENT OF POULTRY AND EGGS

Shipments from Texas Stations

	Cars of Poultry						Cars of Eggs					
	Chickens		Turkeys		Shell		Frozen		Dried		Shell Equivalent†	
*Destination	1945	1944	1945	1944	1945	1944	1945	1944	1945	1944	1945	1944
TOTAL	21	10	16	5	38	24	43	43	60	78	604	734
Intrastate	2	1	....	1	1	20	19	26	7	10	95	152
Interstate	19	9	16	4	37	4	24	17	53	68	509	582
Receipts at Texas Stations												
TOTAL	3	4	0	0	7	66	19	28	8	0	109	122
Intrastate	0	1	0	0	2	17	13	22	7	0	84	61
Interstate	3	3	0	0	5	49	6	6	1	0	25	61

*The destination above is the first destination as shown by the original waybill. Changes in destination brought about by diversion factors are not shown.

†Dried eggs and frozen eggs are converted to a shell-egg equivalent on the following basis: 1 rail carload of dried eggs=8 carloads of shell eggs, and 1 carload of frozen eggs=2 carloads of shell eggs.

NOTE: These data furnished to the Division of Agricultural Statistics, B.A.E., by railroad officials through agents at all stations which originate and receive carload shipments of poultry and eggs. The data are compiled by the Bureau of Business Research.

FEBRUARY CREDIT RATIOS IN TEXAS DEPARTMENT AND APPAREL STORES

(Expressed in Per Cent)

	Number of Stores Reporting	Ratio of Credit Sales to Net Sales 1945	1944	Ratio of Collections to Ouostanding 1945	1944	Ratio of Credit Salaries to Credit Sales 1945	1944
All Stores	63	47.0	46.6	67.0	63.0	1.1	1.2
Stores Grouped by Cities:							
Austin	5	40.7	42.0	80.4	69.6	1.4	1.7
Bryan	3	39.6	39.7	76.9	75.8	2.3	2.0
Corpus Christi	3	42.1	45.9	52.3	58.1	4.8	5.1
Dallas	9	56.5	55.3	66.6	67.4	0.7	0.9
El Paso	3	38.6	37.9	62.9	65.7	1.8	1.8
Fort Worth	6	41.4	40.9	67.9	66.4	1.3	1.4
Houston	8	45.3	43.6	65.1	62.4	1.4	1.6
San Antonio	5	38.1	40.7	71.3	43.4	1.3	1.5
Waco	5	48.8	48.8	63.9	59.8	1.3	1.3
All Others	16	42.9	43.3	63.5	72.5	1.2	1.3
Stores Grouped According to Type of Store:							
Department Stores (Annual Volume Over $500,000)	19	45.2	44.9	68.1	66.6	1.2	1.3
Department Stores (Annual Volume under $500,000)	10	40.4	40.9	54.3	68.5	1.5	1.7
Dry-Goods-Apparel Stores	3	38.6	40.3	65.9	64.8	1.9	2.1
Women's Specialty Shops	19	54.3	52.9	65.6	54.3	0.7	0.9
Men's Clothing Stores	13	40.4	43.7	67.3	67.9	1.7	1.6
Stores Grouped According to Volume of Net Sales During 1944:							
Over $2,500,000	20	44.7	43.5	65.7	67.1	1.3	1.2
$2,500,000 down to $1,000,000	13	40.4	48.1	70.2	70.6	1.8	1.5
$1,000,000 down to $500,000	12	38.2	38.1	66.3	65.3	1.7	1.7
Less than $500,000	18	29.0	32.4	61.2	62.7	3.3	3.8

NOTE: The ratios shown for each year, in the order in which they appear from left to right are obtained by the following computations: (1) Credit Sales divided by Net Sales. (2) Collections during the month divided by the total accounts unpaid on the first of the month. (3) Salaries of the credit department divided by credit sales. The data are reported to the Bureau of Business Research by Texas retail stores.

FEBRUARY RETAIL SALES OF INDEPENDENT STORES IN TEXAS

	Number of Establishments Reporting	Percentage Changes in Dollar Sales Feb., 1945 from Feb., 1944	Feb., 1945 from Jan., 1945	Year, 1945 from Year, 1944
TOTAL TEXAS	956	+11.5	− 1.2	+14.2
STORES GROUPED BY LINE OF GOODS CARRIED:				
APPAREL	115	+18.0	+ 4.1	+18.6
Family Clothing Stores	24	+ 5.3	− 9.4	+13.0
Men's and Boys' Clothing Stores	39	+ 8.8	− 7.5	+ 8.0
Shoe Stores	17	+37.6	− 6.6	+39.8
Women's Specialty Shops	35	+22.3	+12.4	+22.6
AUTOMOTIVE*	83	−10.0	−11.7	− 8.0
Motor Vehicle Dealers	74	−12.5	−12.7	−10.8
COUNTRY GENERAL	92	+ 1.7	− 6.8	+ 7.5
DEPARTMENT STORES	63	+14.3	+ 4.0	+16.5
DRUG STORES	101	+11.2	− 4.8	+ 9.8
DRY GOODS AND GENERAL MERCHANDISE	29	+25.9	− 1.8	+26.0
FILLING STATIONS	27	− 1.1	− 5.8	+ 2.5
FLORISTS	21	+13.0	+ 7.2	+14.8
FOOD*	123	+ 5.6	− 1.4	+ 6.3
Grocery Stores	31	+ 0.4	− 5.7	+ 2.5
Grocery and Meat Stores	84	+ 6.5	− 0.4	+ 6.9
FURNITURE AND HOUSEHOLD*	68	+ 9.0	−12.0	+18.3
Furniture Stores	63	+10.2	−11.9	+19.1
JEWELRY	25	+ 0.8	− 6.4	+ 5.0
LUMBER, BUILDING, AND HARDWARE*	158	+24.2	−15.8	+32.3
Farm Implement Dealers	12	+15.3	+ 0.3	+18.6
Hardware Stores	48	+ 7.0	−15.6	+20.7
Lumber and Building Material Dealers	96	+31.8	−18.2	+40.2
RESTAURANTS	32	− 2.7	−10.2	+ 2.3
ALL OTHER STORES	13	+ 5.8	+ 0.6	+ 4.0
TEXAS STORES GROUPED ACCORDING TO POPULATION OF CITY:				
All Stores in Cities of—				
Over 100,000 Population	150	+17.1	+ 4.6	+17.5
50,000–100,000 Population	124	+ 9.4	− 5.8	+13.7
2,500–50,000 Population	469	+16.6	− 6.4	+ 9.2
Less than 2,500 Population	213	+ 5.1	− 8.0	+12.3

*Group total includes kinds of business other than the classification listed.

Prepared from reports of independent retail stores to the Bureau of Business Research, coöperating with the U.S. Bureau of the Census.

BUILDING PERMITS

	Feb., 1945	Feb., 1944	Jan., 1945
Abilene	$ 15,220	$ 7,605	$ 12,935
Amarillo	111,988	7,115	151,783
Austin	192,027	18,038	164,223
Beaumont	82,295	166,923	74,867
Big Spring	57,765	9,500	21,815
Brownsville	12,079	3,065	14,952
Cleburne	7,535	3,225	1,800
Coleman	4,500	0	0
Corpus Christi	139,941	138,830	177,632
Dallas	293,990	312,729	497,720
Denton	3,950	3,550	1,861
Edinbhrg	10,500	1,903	870
El Paso	20,506	26,646	100,469
Fort Worth	387,732	191,709	361,047
Galveston	66,004	103,811	53,192
Gladewater	350	1,725	2,000
Graham	2,150	1,665	2,320
Harlingen	22,300	1,950	15,844
Houston	1,037,809	438,540	622,503
Jacksonville	4,800	1,850	4,150
Kerrville	16,180	675	15,605
Lubbock	177,996	32,304	146,128
McAllen	25,720	7,485	21,280
Marshall	10,581	5,866	43,072
Midland	66,950	4,600	32,113
New Braunfels	16,635	500	10,054
Palestine	475	1,400	3,720
Pampa	48,300	9,700	25,000
Paris	9,850	8,620	6,920
Plainview	6,150	200	11,141
Port Arthur	17,318	6,340	26,804
San Antonio	422,304	383,809	415,979
Seguin	810	3,600	1,825
Sherman	17,643	10,102	8,935
Snyder	0	0	1,000
Sweetwater	12,830	2,590	4,175
Texarkana	21,550	3,535	22,210
Tyler	30,636	7,678	21,947
Waco	109,333	147,755	37,189
Wichita Falls	10,937	17,630	24,600
TOTAL	$3,495,639	$2,085,268	$2,539,177

Note: Compiled from reports from Texas chambers of commerce to the Bureau of Business Research.

POSTAL RECEIPTS

	Feb., 1945	Feb., 1944	Jan., 1945
Abilene	$ 41,248	$ 40,331	$ 46,757
Amarillo	59,966	51,581	65,047
Austin	99,729	99,659	118,172
Beaumont	48,776	40,926	55,426
Big Spring	11,499	9,645	16,354
Brownsville	12,023	9,902	14,783
Childress	6,677	5,226	7,464
Cleburne	6,188	5,250	6,803
Coleman	4,015	3,651	5,347
Corpus Christi	72,953	60,527	80,031
Corsicana	10,322	8,636	12,094
Dallas	571,852	501,186	626,188
Del Rio	6,517	5,474	8,159
Denison	10,381	9,034	12,376
Denton	11,963	11,167	17,534
Edinburg	4,398	4,033	5,641
El Paso	90,578	86,506	114,732
Fort Worth	276,205	217,654	300,130
Galveston	51,459	48,402	55,260
Gladewater	4,328	3,715	5,840
Graham	3,623	3,178	4,408
Harlingen	14,884	11,210	18,220
Houston	379,645	334,677	448,109
Jacksonville	5,064	4,708	6,425
Kenedy	2,165	2,164	2,506
Kerrville	4,000	3,359	4,913
Lubbock	35,335	29,836	44,483
Lufkin	7,057	6,187	9,892
McAllen	8,407	6,123	10,341
Marshall	11,596	9,833	13,703
Midland	15,861	10,456	15,859
Palestine	8,559	7,245	10,152
Pampa	11,350	9,509	14,713
Paris	24,695	19,759	30,372
Plainview	6,929	5,914	7,164
Port Arthur	27,185	25,199	31,113
San Angelo	23,152	19,706	28,328
San Antonio	253,172	242,054	284,591
Sherman	13,434	11,424	15,159
Snyder	2,390	2,134	3,351
Sweetwater	7,818	8,244	8,379
Temple	16,947	14,917	18,558
Texarkana	27,858	25,425	39,833
Tyler	29,050	27,940	33,502
Waco	55,505	48,725	62,524
Wichita Falls	43,476	40,647	50,821
TOTAL	$2,440,234	$2,153,078	$2,791,557

Note: Compiled from reports from Texas chambers of commerce to the Bureau of Business Research.

FEBRUARY RETAIL SALES OF INDEPENDENT STORES IN TEXAS

(By Districts)

	Number of Establishments Reporting	Percentage Changes Feb., 1945 from Feb., 1944	Feb., 1945 from Jan., 1945	Year, 1945 from Year, 1944
TOTAL TEXAS	956	+11.6	− 1.2	+14.2
TEXAS STORES GROUPED BY PRODUCING AREAS				
District 1–N	63	+ 7.1	− 5.7	+19.8
Amarillo	22	+ 9.3	+ 2.8	
Plainview	11	+24.4	− 5.9	
All Others	30	+ 2.3	−11.6	
District 1–S	28	+ 8.7	− 8.8	+13.5
Lubbock	16	+ 8.7	−10.7	
All Others	12	+ 8.4	− 1.9	
District 2	79	+15.0	− 4.8	+15.3
Abilene	22	+16.7	− 3.0	
All Others	57	+12.3	− 7.4	
District 3	33	+10.7	−10.7	+18.9
District 4	220	+15.3	+ 4.1	+16.2
Dallas	33	+17.4	+ 6.7	
Fort Worth	31	+18.2	+ 9.1	
Waco	28	+ 4.2	− 9.1	
All Others	128	+ 8.1	− 7.8	
District 5	106	+ 6.0	+ 3.0	+10.7
District 6	36	+ 9.2	−10.0	+12.6
District 7	56	− 3.1	−16.5	+ 5.4
District 8	167	+14.3	− 5.1	+17.7
Austin	14	+15.5	− 2.7	
Corpus Christi	27	+12.8	− 0.6	
San Antonio	45	+17.4	− 7.3	
All Others	81	+ 1.0	− 5.7	
District 9	93	+11.2	+ 5.8	+12.2
Houston	41	+15.0	+12.8	
All Others	52	+ 4.6	− 5.2	
District 10	26	+ 8.0	−11.2	+12.1
District 10A	49	−11.6	− 7.2	−10.3

Note: Prepared from reports of independent retail stores to the Bureau of Business Research, coöperating with the U.S. Bureau of the Census.

TEXAS COMMERCIAL FAILURES

	Feb., 1945	Feb., 1944	Jan., 1945
Number	0	0	1
Liabilities*	0	0	$10
Assets*	0	0	$ 9
Average Liabilities per Failure	0	0	$10

*In thousands.

Note: From Dun and Bradstreet, Inc.

PETROLEUM

Daily Average Production (In Barrels)

	Feb., 1945	Feb., 1944	Jan., 1945
Coastal Texas*	562,100	516,600	552,600
East Central Texas	144,200	111,900	144,050
East Texas	392,000	390,600	378,300
North Texas	148,800	139,950	143,150
Panhandle	88,000	102,000	88,700
Southwest Texas	347,000	288,250	342,350
WEST TEXAS	464,300	362,000	478,600
STATE	2,147,350	1,911,300	2,127,750
UNITED STATES	4,755,550	4,401,800	4,715,500

*Includes Conroe.

Note: From American Petroleum Institute. See accompanying map showing the oil producing districts of Texas.

Gasoline sales as indicated by taxes collected by the State Comptroller were: January, 1945, 113,617,721 gallons; January, 1944, 92,864,246 gallons; December, 1944, 105,073,427 gallons.

January sales to the United States Government as recorded by motor fuel distributors in Texas were 308,421,714 gallons.

PERCENTAGE CHANGES IN CONSUMPTION OF ELECTRIC POWER

	Feb., 1945 from Feb., 1944	Feb., 1945 from Feb., 1945
Commercial	− 3.3	−11.5
Industrial	+20.3	− 4.7
Residential	+10.3	− 5.0
All Others	−24.6	− 0.4
TOTAL	+ 5.0	− 5.2

Prepared from reports of 9 electric power companies to the Bureau of Business Research.

TEXAS CHARTERS

	Feb., 1945	Feb., 1944	Jan., 1945
Domestic Corporations:			
Capitalization*	$526	$844	$531
Number	70	48	24
Classification of new corporations:			
Banking-Finance	2	2	2
Manufacturing	7	8	3
Merchandising	16	9	4
Oil	2	2	4
Public Service	6	0	1
Real Estate Building	8	9	6
Transportation	5	2	2
All Others	24	16	2
Number capitalized at less than $5,000	44	14	8
Number capitalized at $100,000 or more	1	0	0
Foreign Corporations (Number)	10	14	20

*In thousands.
NOTE: Compiled from records of the Secretary of State.

LUMBER

(In Board Feet)

	Feb., 1945	Feb., 1944	Jan., 1945
Southern Pine Mills:			
Average Weekly Production per unit	194,041	201,945	191,465
Average Weekly Shipments per unit	203,118	217,092	193,305
Average Unfilled Orders per unit, end of month	1,489,477	1,775,386	1,577,775

NOTE: From Southern Pine Association.

COMMODITY PRICES

	Feb., 1945	Feb., 1944	Jan., 1945
Wholesale Prices:			
U. S. Bureau of Labor Statistics (1926=100)	105.2	103.6	104.9
Farm Prices:			
U. S. Bureau of Labor Statistics (1926=100)	127.0	122.5	126.2
Retail Prices:			
Food (U. S. Bureau of LLabor Statistcn (1935–1939=100)	136.5	134.5	137.3
Cost of Living Index (1935–1939 =100)	126.8	123.7	127.1
Department Stores (Fairchild's Publications January, 1931=100)	113.4	113.3	113.4

CEMENT

(In Thousands of Barrels)

	Jan., 1945	Jan., 1944	Dec., 1944
Texas Plants:			
Production	553	430	501
Shipments	512	449	385
Stocks	1,050	1,116	1,010
United States:			
Production	6,379	6,322	7,387
Shipments	4,873	5,040	4,595
Stocks	21,369	24,434	19,785
Capacity Operated	31.0%	30.0%	36.0%

NOTE: From U.S. Department of Interior, Bureau of Mines.

CEMENT

(In Thousands of Barrels)

	Feb., 1945	Feb., 1944	Jan., 1945
Texas Plants:			
Production	465	479	553
Shipments	497	470	512
Stocks	1,018	1,124	1,050
United States:			
Production	5,371	5,686	7,387
Shipments	4,574	5,055	4,595
Stocks	22,164	25,059	19,785
Capacity Operated	29.0%	29.0%	36.0%

NOTE: From U.S. Department of Interior, Bureau of Mines.

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